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The committee on Graduate Study and Research of the Association of Collegiate Schools of Architecture held a conference in Chicago (Arpil 1968) to study possible innovations in architecture and architectural education. Drawing upon the experiences of educators in the areas of medicine, engineering, and research design, the conferees studied the problems and opportunities in developing graduate study, scholarship, and research in architecture. The educators concentrated on the urgent need of architects, in school and in practice, for more knowledge about developments in all aspects of science and technology and about the effective application of new ideas and techniques to architecture. From the conference, four resolutions were formed and presented to the annual meeting of the Association of Collegiate Schools of Architecture where they were approved. (LH)

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PREPARATORY STUDY TOWARD THE IMPROVEMENT OF EDUCATION IN COLLEGIATE SCHOOLS OF ARCHITECTURE

Committee on Graduate Study and Research
Association of Collegiate Schools of Architecture
Principal Investigator: Burnham Kelly
Grantee: Cornell University, Ithaca, N.Y.

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Table of Contents

Abstract 1

Introduction 2

Chapter One - Graduate Study and Research in Architecture, Burnham Kelly 4

Chapter Two - The Proposed Graduate Program in Architecture at the University of California in Berkeley, Gerald M. McCue 16

Chapter Three - Some Comments on the Present State of Medical Education in the United States 26

Chapter Four - Observations of an Engineering Educator, Benjamin Nichols 37

Chapter Five - The Design Scientist--Role and Training, Carlisle P. Runge and Herbert S. Heavenrich 44

Chapter Six - Graduate Education Programs on the National Science Foundation, Alice P. Withrow 58

Chapter Seven - Formal Action by the Association of Collegiate Schools of Architecture, Burnham Kelly 64

Conclusion and Evaluation 71

Appendix A - Agenda of Chicago Conference 72

Appendix B - Participants at Chicago Conference 73

Abstract

This report contains the findings of a project to support the development of new scholarship and research programs within the schools of architecture. Although administrative direction of the project was assigned to Cornell University, the work was that of the Committee on Graduate Study and Research of the Association of Collegiate Schools of Architecture, with financial support from the Office of Education and the Graham Foundation. The committee organized and held a conference of architectural educators on graduate study in architecture, presentations at which pointed out problems and opportunities in the proposed development and drew on the experience of comparable fields. From the Conference discussion were drawn a series of resolutions in support of the proposed development, which were presented to the annual convention of the Association of Collegiate Schools of Architecture and approved. A statement of the general development proposal, edited versions of conference presentations, and a summary of subsequent committee actions make up this report.

Introduction

Starting in 1964, the Committee on Graduate Study and Research of the Association of Collegiate Schools of Architecture sought a supporting grant to plan and hold a conference of architectural educators on the development of programs of scholarship and research within the schools of architecture. Such a development seemed to the committee to be of great potential value to the profession, which was deeply concerned with a redefinition of its aims and responsibilities, and to the schools, many of which were already engaged in substantial curriculum revision.

A grant was made to Cornell University by the US Office of Education in June, 1967, for this purpose, and an additional grant was later obtained from the Graham Foundation for Advanced Study in the Fine Arts to help school representatives with travel expenses and enrich the conference program.

An initial discussion of objectives and proposals for consideration at the conference was held by the committee in a special session at the AIA Research Conference in Gatlinburg, Tennessee, in October, 1967. It was agreed that, among the many problems facing architectural educators, one of the most pressing is the need to establish within the architectural schools themselves a base of knowledge regarding modern developments and techniques of all sorts on which to build an improved training for the professionals who will design our architectural environment. It is clear that the schools can no longer count on having an appropriate base of knowledge supplied from the outside, as was done in less confusing times.

Experience in professional education in such fields as medicine and engineering has shown the immediate value of research-based programs of graduate study. The obvious goal of training scholars, specialists, and teachers has been accompanied by improvement in the quality of undergraduate instruction in those institutions offering the increased breadth of experience and interdisciplinary teamwork of sound research.

Certain areas of concentration are essential for the professional degree. The future architect needs to be acquainted with the history, philosophy, and psychology of his profession. He needs a sound preparation in the materials and techniques of modern construction as well as in the complexities of design. The alliance of the practical and the aesthetic may be very tenuous elsewhere, but it is the absolute bedrock of architecture.

In addition to the expected spillover to the basic professional curriculum, the incorporation of special graduate scholarship and research programs would serve both industry and government. The opportunities for multidisciplinary approaches to various large problems exist a priori on the university campus. The capable engineer or social scientist who would not initiate a research program of his own in so complex a field may become involved in the challenge of contemporary environmental design, and contribute in setting up experimental projects. The existence of libraries, laboratories, and on-going research program offers countless opportunities for collaboration and new insights.

Yet the schools of architecture have had little experience with programs primarily concerned with scholarship and research, and less with those leading to the PhD degree, but many were interested in setting up such programs and some had already done so. The time seemed appropriate for a consideration of the problem by the schools as a group.

Plans for the conference were detailed in the months following the Gatlinburg meeting, and the conference took place in Chicago in April, 1968, in meeting rooms made available through the Graham Foundation and the College of Architecture and Art at the University of Illinois Chicago Circle Campus. Much of this report is derived from conference presentations dealing with the general problem of graduate programs of scholarship and research and with pertinent insights from the experience of the fields of medicine, science, and engineering.

On the basis of agreements reached among the Conference participants, a series of resolutions were prepared for and approved by the annual convention of the Association of Collegiate Schools of Architecture in Portland, Oregon, in June, 1968. A discussion of the Convention actions makes up the last section of this report.

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Chapter One

GRADUATE STUDY AND RESEARCH IN ARCHITECTURE

by Burnham Kelly

This chapter presents the general position developed by the Committee on Graduate Study and Research of the Association of Collegiate Schools of Architecture and made the subject of a conference of architecture educators in Chicago and of a session of the annual convention of the Association in Portland, Oregon.

Burnham Kelly served as Co-Chairman of the Committee. He is Dean of the College of Architecture, Art, and Planning at Cornell University.

1. General

There is no need to dwell on the complexity of the field of architecture. The subject has been well covered, and indeed is only a special case of the complexity of all human activity at a time of rapidly accelerating growth in knowledge, resources, problems, aspirations, and overall communication.

Within the field, vast changes are already obvious. For the student who prepares to design our architectural environment it is hard to place a limit on the subjects of his likely concern. The challenge to the schools is to find a balance between a conceptual understanding of relevant new knowledge, a practical familiarity with new operational techniques, and a capacity to create design solutions to problems for which there is no clear answer and often not even a clear problem statement. Under the circumstances, it is understandable that we should join the many who reach out for help to those models of modern know-how, the computer technologists and the systems analysts.

For architects there is a further problem: it is an essential part of our profession of faith that we do not merely serve, but also seek to raise, the goals of our society. In a sense this broader mission is inescapable.

> "The architect's unseen client is almost always society itself. He who pays the piper calls the tune, but the tune, as played by the architect, falls on all our ears."[1]

Today, however, we are less than ever agreed upon goals. Here again, we reach out for help from the presumed experts.

> "Like the members of most other professions and disciplines, architects are now ethical relativists, confused about what is good or bad for man, for the community and for society. They turn to the sociologist in the hope that his discipline has somehow been spared this form of demoralization.----It is no wonder that (they) should be disappointed."[2]

Faced with this situation, educators may be counted on to talk, and talk we do in conferences, articles, and reports, and often to little effect. As John Kenneth Galbraith puts it:

> "Next only to business men, educators have acquired the habit of lecturing each other on their social responsibilities, and as a necessary counterpart, since reaction to this flood of adjuration would be impossible, of ignoring it."[3]

Yet the schools of architecture have seen in the last few years more forthright experiments in curricula and innovations in teaching methods than in any period since the general overhauling that took place during and after the great depression of the nineteen thirties.

Two major trends are in evidence, the first concerned primarily with the long-standing role of architecture as one of the humanities, the second with its rapidly emerging technological and scientific components.

First there is concern for the intellectual maturity of those who would design our architectural environment. This has led to a demand for increased general-education content in architectural curricula. A growing number of professional programs admit students only after two or four years of general preparation. Other programs, recognizing the importance to highly motivated students of early design participation in a field that calls for an integrated design skill, seek the same objective by remodeling or extending their curricula.

Second, there is a desire to bridge the gap between the complex art of architecture and the foundations in science and technology upon which modern design and construction must rest. New approaches to problems of materials and structures, of mechanical services, of building and urban systems, and of human requirements and preferences have appeared in many programs since it has become clear that the schools must go more than half way in building the necessary bridges.

In the main, these changes reflect a recognition of the vast changes taking place in the practice of architecture as more and more of the work of design is handled by larger and more complex organizations and as the typical commission becomes a mixed public-private enterprise, directed by a complex committee-client and devoting several years to the establishment of a social, economic, political and entreprenurial framework that largely shapes the architectural design. The architect tends to become only one of many participants in a decision process which increasingly in the future will incorporate the operations of construction and management as well as design.

With these developments must come changes in the legal and institutional structure of the profession: contract documents; fee schedules; examination, registration, and licensing procedures; public responsibility and liability; and the ethical base itself of architecture. Nothing is sacred.

It is worth noting that the overwhelming scope and diversity of these considerations has led to a tendency to concentrate attention on the elements of architecture that can most readily be reduced to facts, figures, and formulae, making it increasingly hard to preserve for the intangibles the important role they deserve. The problems of dealing with implications of form are thus increased. In the press for a better base of knowledge, it must never be forgotten that architecture has an equally basic commitment to form.

2. Scholarship and Research

Many conscientious educators, aware of the need on the part of the architect for a broad understanding of the social and economic, as well as the scientific and technological, problems and potentials facing him, seek to incorporate into the basic professional curriculum an exposure to all these matters. They face three basic limitations: available time at the university, specialized capacities and interests on the part of the students, and scarcity of men able and willing to make effective translations from complex bodies of knowledge to the conceptual base required by the architect. Each new architectural program must find its own compromise among these limitations, added to the traditional limitations of space and funds.

There can be little doubt that a broad base of knowledge is needed to support the improvement of architectural education and practice. Advances in all of the sciences have been rapid; advances in the problems of society have been even more rapid. Not only is there a need for specific information, but also there is a need for a heightened perception of the nature of the problems with which we deal. The broadening of the design responsibility of the professional comes at a time when the content of each area of concern is expanding at an accelerating pace.

In many of the traditional disciplines, there is an increasing concern for the problems of an urban society, as seen from the special viewpoint of the discipline, but applications to the design professions are rarely explored. Even the engineering fields that once supplied technical specialists to architecture have turned away, to deal with problems from more specialized sponsors. There seems to be no effective substitute for the development of the required programs of scholarship and research within the architectural schools themselves. Needed are a variety of curricula, complementary to the present programs for professional practitioners, in which students who are so motivated and qualified may prepare themselves for the important roles of supporting scholarship and research through graduate study leading to advanced degrees. Many current considerations are favorable, from the support formula of state and federal agencies and the concern of foundations to the desires of students and faculty alike. Interest within the schools of architecture is keen, but relatively few have as yet taken specific steps to establish such programs. The results of a questionnaire taken by the Committee indicate that only a dozen schools now offer a master's degree with a concentration on scholarship and research, and only five offer the doctor of philosophy degree, with an annual output of only six or seven doctorates.

The educational benefits to regular programs of such special programs of scholarship and research are well known. They draw to the school specially trained and skilled men, who attract in their turn bright new junior faculty, research assistants, and graduate students. The impact of these men and their work on the regular student is great even if it is only through informal personal contact and the enrichment of course materials. It usually goes far beyond, reshaping curricula and attracting many of the best students to special graduate work. In both medicine and engineering, it has been essential to the effective operation of the field to develop within the professional schools extensive programs of scholarship and research. The experiences of these fields are not perfectly applicable, but they can be highly valuable to architecture both in demonstrating the advantages of such programs and in suggesting ways of bringing them into being. This is the subject matter of later sections of this report.

It is not necessary, however, to require that individual contributions to scholarship and research be part of the education of every architect. Indeed the gifted professional and the contributing scholar-researcher usually tend to be two different kinds of man. Among the schools of architecture, there is a healthy and important tendency to build up the content of scholarship and research within the basic professional curricula, which have as their primary objective the preparation of practicing professionals. It may be expected, however, that some of these students and some others from related fields will develop particular interests in scholarship and research on aspects of architecture and will want to pursue their interests in graduate programs specifically devoted to these interests rather than to preparation for practice. It is with such special graduate programs that this report is primarily concerned.

3. The Degree Structure

The trend towards the development of graduate degrees extends throughout the US education system. In general, the bachelor's degree is awarded at the end of four years of study, the master's degree takes a year or two, and the doctorate requires an additional two or more years. This trend is becoming visible in the architectural schools. The five-year undergraduate professional program leading to the degree of Bachelor of Architecture was until recently the program of almost all of the schools. In recent years, however, a sizeable minority have turned to six-year programs which offer an opportunity for broader coverage, an intermediate degree of Bachelor of Arts or Bachelor of Sciences at the end of four years, and then, usually, the degree of Master of Architecture. There is in addition a small but growing group of schools that offer an entirely graduate professional degree, requiring a bachelor's degree for entrance; the older among these schools gave the degree of Bachelor of Architecture, but the clear trend today is for such programs to give the degree of Master of Architecture.

The confusion of degree titles in architecture is compounded by the fact that many schools offer advanced degrees, beyond the first professional degree, which are also essentially professional in aim and content. At one time the typical program of this sort required a single additional year of mainly studio work and led to the degree of Master of Architecture. Today, many additional programs are offered, usually requiring two years and leading to such degrees as Master of Urban Design, or Master of City Planning. In a few cases, however, these advanced degrees programs are genuinely concerned with scholarship or research, as for example in history or in structures, and in other cases the content of the program is decided from among a number of special options or by consultation with faculty, and may be substantially oriented to scholarship or research.

In consequence, there is a growing confusion among the proliferating graduate degrees. The Master of Architecture degree for example, may be the first professional degree; it may represent advanced professional work in a field like urban design; or it may represent scholarly or research accomplishment in a field like history or structures. A man holding an initial professional master's degree could gain a second master's degree for advanced professional work and then a third for advanced scholarly or research work. The school, contemplating such a possibility, often wants to change one or both of the advanced degrees to doctorates. At that point, it will have to consider a number of related problems.

First, there is the problem of maintaining academic standards. In the long run, it is clearly against the self-interest of any school of architecture to contribute to the sort of general devaluation of the doctorate that has been encountered in some educational fields. An early effort to set standards for the doctorate, while the degree is still rare, will prove valuable to all of the schools.

Second, there is a choice to be made between the professional doctorate and the degree of Doctor of Philosophy, traditionally awarded for significant contributions in scholarship and research. Both may be appropriate within a single school; the latter is the principal concern of this report because it is a common objective and the appropriate sign of distinction for the sort of men who must be attracted to the schools of architecture if the broad base of knowledge is to be developed on which to support necessary improvements in education and practice.

Men of this sort may have originally contemplated a practitioner's role, or they may have been attracted from other fields of scholarship or research; they do not intend to practice for the public as professionals, however, and are not interested in adding professional degrees. Within the schools, furthermore, they deserve to be regarded as first rate specialists rather than as second rate professionals. In medicine, the biochemists and anaesthesiologists are understood to be, not public practitioners, but expert guides and advisers for the public practitioners. In architecture a broad range of comparable experts is urgently needed. Medicine made rapid advances following the development of research within the medical schools. Architecture now needs to make comparable advances.

4. Requirements of the Doctor of Philosophy Degree

The distinction between the Professional Doctorate and the Doctor of Philosophy is clearly made in the excellent booklets published by the Association of Graduate Schools in the Association of American Universities.[4]

Generally speaking, university faculties and graduate schools have attempted to protect the quality of the Doctor of Philosophy degree, and have established for it specific requirements in major studies, minor studies, general studies, foreign language studies, general examinations, and dissertations. The booklets explain the additional standards routinely called for in terms of faculty members and training, student background and quality, administrative backing, library and other facilities, and funds. The last is by no means the least important, since it is far more expensive to a university to train a doctoral candidate than a master's candidate--sometimes three or more times as expensive.[5] In most schools of architecture, these standards represent serious obstacles.

It is not particularly difficult in most universities to obtain approval for a new doctoral program if the department contains three or four men, preferably in their thirties, who themselves have the doctorate, have demonstrated their capacity in the field, can define with assurance the program and its goals, and can bring to the program a good part of the necessary financial support. Such men are in short supply in general, and in architecture the total number of present or prospective faculty members who have done serious research work and hold the Ph.D. degree is distressingly small. Faculty members must be attracted from related fields, which takes a lot of money, or developed, which takes a lot of both money and time. Both alternatives require high organization skill and a cooperative administration.

The techniques of seduction of men from related fields are well known: their interest and the value of their possible contribution are established in carefully planned and published colloquia, conferences and summer institutes; grants are obtained and specialized facilities made available; a scholarly journal of high quality is created so that they may publish the papers that will advance them in their careers. Needless to say, each such faculty addition will want, as indeed the school will want, graduate students, and these expect to be supported by assistantships or scholarships. There is intense competition for the better students among fields far better able to tap sources of funds than architecture, so the task will not be easy. The students will select the field, and they must believe that it is both important and on the move.

It is no longer possible to doubt that men turned out of the architectural schools with high scholarly and research qualifications will have rewarding careers. The indications are that the schools themselves will be glad to snap up the few we could produce in the next several years, and the large architectural offices, the new industrial teams, and the government agencies can be counted upon to compete effectively for these few. The importance of the problems to be solved in this time of urban crises is clear. If the architectural profession cannot rise to the occasion, others will take over.

It is essential, therefore, to encourage the establishment within the architecture schools of graduate programs of scholarship and research leading to the degree of doctor of philosophy. This will not be easily accomplished. Those interested are referred not only to the pamphlets mentioned above, but also to the later sections of this report in which the problems faced in one university are set forth in detail and lessons from comparable fields are brought out. Perhaps the largest problem of all, however, since in a sense it affects all the others, is the problem of funds. Where can the schools find the necessary funds?

5. Sources of Support

The major sources of support are the familiar ones: foundations, government agencies, related industries and the profession itself. Architecture has never in the past found it easy to raise research funds; the scientists regarded it as a humanist art, and the humanists regarded it as an applied technology. The increase in general public and specific political awareness of the importance of raising the quality of our three-dimensional physical urban environment alters this situation; a bold program of action today stands a vastly improved chance of support. But the schools must satisfy the major foundations and government agencies that they have a contribution to make in the solution of major problems. In the past, foundations and industry have sponsored conferences of architectural educators on several occasions; they have usually been disappointed with the results, not because the architects lacked professional skill but because they lacked the inclination and qualifications to cope with highly complex problems in a scholarly manner.

In recent years, often as a result of pressure from the practitioners on the one hand and the students on the other, several schools have begun to develop breadth and strength in their graduate programs and many more are interested in taking steps in this direction. They find it hard to raise the necessary funds. In order to make significant progress at this time, it may well be that the best approach to sources of funds would take the form of joint action by the schools as a group. This would permit a careful analysis of present deficiencies and of the appropriate steps to correct them, and a rational allocation of scarce resources for mamimum general benefit. Such an approach should elicit an appreciative response from potential sponsors. To increase the number of graduate fellowships, the schools could follow the example of several other fields and seek support for several at once, to be allocated by a special committee representing all the schools. One such fellowship is currently awarded by the ACSA Committee on Graduate Study and Research, and has already demonstrated its educational value.[6] A joint approach to the AIA, the foundations, the government agencies, industry, and the large offices might bring results when an individual approach would seem to lack adequate promise of success. It would have the feature of making it possible for a donor to support the general program in its initial stages without having to decide the merits of individual requests from many different universities. Effective use could be made of the matching grant approach to encourage contributions by the profession and industry as a demonstration to the foundations and government agencies of the depth of concern and the effective need for substantial results.

A fellowship program of this sort would be essential in order to provide the numbers of graduate students needed for the growth of several successful research programs. It would also offer the means by which salary differentials could be made up for young teachers granted a leave by their universities to take advanced graduate work in preparation for returning to develop programs of graduate study and research at home. Experience in other fields with comparable fellowship programs indicates that they have had a profound effect in drawing students, faculty, and research to the schools.

It may be asked why the large majority of architecture schools with little present prospect of graduate programs of scholarship and research should be asked to join in an effort that is likely to work to the immediate benefit of the few schools that are already favored in resources. There are several answers. For one, the separate approaches of the separate schools generally have been inadequate and have met with little success; the joint approach may well bring benefits sooner than going it alone. For another, it is possible to provide a quid pro quo. Allocations of fellowships to a favored school may be conditioned on bringing benefits to its less favored neighbors. Such benefits might take different forms. Grants to individual schools could be subject to agreement to use their new resources to give short periods of specialized teaching in several schools in their region. They could also be required to devote specific resources to the development of teaching materials and texts for the benefit of all the schools. And special attention could be paid to development assistance grants for young faculty on leave from and scheduled to return to other schools.

A joint approach, demonstrating a common awareness and determination among the schools, may make a significant difference in obtaining other prime requisites in the development of scholarship and research. A high-quality journal in which scholars and researchers may publish with assurance of informed readership and appropriate academic recognition is expensive to develop and produce, but it is a must if architecture is to attract and develop the needed manpower.

Of comparable importance is the funding of special conferences and summer institutes. The medical profession found these among the most important devices for faculty development. Architecture already has taken some first steps in the AIA Research Conferences and the AIA-ACSA program of teachers' seminars. To attract greater public interest and financial support, it is essential to develop additional conferences and institutes at the highest intellectual levels, focussed on the contribution that may be made by the profession to the solution of one or another of the most pressing problems of the day, attended by outstanding experts, and resulting in respected publications. We shall have to demonstrate our capacity to make a significant contribution before we shall gain significant support.

The benefits of joint action are clearly demonstrated in the consortium of eleven major midwestern universities known as the Committee on Institutional Cooperation (CIC, under which a graduate student in any one of the universities may take advantage of special programs offered in another.)[7] The CIC is more than an educational convenience; it is also a channel for the formulation of broad educational policy. It has set up a Council on Economic Growth, Technology, and Public Policy under which crucial development problems within its broad region are identified for interdisciplinary research and action. One current activity of interest to architecture is its Ad Hoc Committee on Urban and Regional Design, concerned in part with the community problems generated by the development of the vast new atomic energy research facility being developed outside of Chicago.

Other forms of joint action are worthy of consideration. Midwestern universities are also working through the thirty members of the Argonne University Association, and eastern universities have long operated specialized facilities through the device of Associated Universities, Inc. Robert Geddes and Bernard Spring in the AIA-sponsored Study of Education for Environmental Design,[8] proposed that regional consortia of schools and professional associations be formed to sponsor Institutes of Advanced Study, to give gifted teachers a period of revitalization and offer a base for creative scholars and researchers. More modest but perhaps more immediate benefits may come from joint efforts to develop cooperative programs with related disciplines within a university or a group of nearby universities.

In all that has been said here, no implication is intended that joint efforts will or should supersede individual efforts. The most effective proposals for foundation support undoubtedly will always be those of highly qualified researchers with appropriate supporting facilities, well identified and significant objectives, and a clear idea of an effective approach to those objectives. The individual schools, the AIA, and others provide important resources for educational development. What is here proposed is a means of broadening and strengthening these resources so that we may make rapid headway in the development of scholarship and research, for it is a slow process at best and the urban crisis before us is mounting at an alarming rate. Architecture must support such a development or face the inevitable decline of its role in our society.

At a time when the professionals and the schools are broadly and deeply concerned with the redefinition of the scope and responsibilities of architecture and the reshaping of the curricula by which students are prepared for the profession, it is of the utmost importance that decisions be made and policies set on the basis of the best possible understanding of the emerging complex of problems and potentials. Insights and intuitions from an inadequate base of knowledge may do more harm than good in the long run. Not the least important contribution of programs of scholarship and research, therefore, is the establishment of a base on which substantial and not illusory progress may be made towards the redefinition of the profession and the reshaping of school curricula.

Footnotes to **Chapter One:**

1) Leonard J. Fein, "Ideology and the Architect" in Planning for Diversity and Change, Ed., Stanford Anderson, MIT Press, Cambridge, 1968, 326 pp. at p. 196.

2) Robert Gutman, "What Architecture Schools Expect from Sociology", AIA Journal, Vol 43 No 3, March 1968, pp 70-76, at p. 74.

3) The New Industrial State, Houghton Mifflin, Boston, 1967, 427 pp, at p. 375.

4) The Doctor of Philosophy Degree, a statement by The Association of Graduate Schools in the Association of American Universities and the Council of Graduate Schools in the United States, Fifth Printing, February 1968; The Doctor's Degree in Professional Fields, a statement by the Association of Graduate Schools in the Association of American Universities and The Council of Graduate Schools in the United States, Second Printing, February 1967; and New Doctor of Philosophy Degree Programs, a statement by the Council of Graduate Schools in the United States, Fifth Printing, February 1969.

5) Joseph M. Pettit, "On Changing Status of Graduate Engineering Education", Journal of Engineering Education, Vol 57, No 5 (January 1967), pp 363-368.

6) The AMAX, ACSA Fellowship.

7) See Chapter Five - by Carlisle P. Runge and Herbert S. Heavenrich

8) Often referred to as the AIA-Princeton Report.

Chapter Two

THE PROPOSED GRADUATE PROGRAM IN ARCHITECTURE AT THE UNIVERSITY OF CALIFORNIA IN BERKELEY

by Gerald M. McCue

The Department of Architecture of the University of California in Berkeley has recently gone through the experience of planning and developing a program leading to the Ph.D. degree. The lessons learned from this experience were presented to the representatives of other schools at the Chicago Conference.

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A specific case is the best way to explore the implications of a policy of developing graduate study in architecture. It will permit me to be specific about some of the problems that we've encountered and which have absorbed our interest in the last two years while working on the development of an advanced graduate program on the Berkeley campus.

Plans for an advanced graduate program have been discussed for several years, but about three years ago the faculty of the Department of Architecture began to talk seriously about it. At that time the faculty decided that before it could consider an advanced graduate program, it would be necessary to revise the regular programs first. As a consequence, we spent about a year and a half in study and then made major changes in all of our professional undergraduate and graduate programs. At the same time we began to establish priorities for extending our faculty so that we might have better capability for doctoral-level study.

Some of our faculty say we're still not doing a very good job at our professional graduate programs and wonder why we should try to take on additional problems. This is a logical question, but I believe that in some ways the establishment of a clearly research-oriented graduate program will bring many benefits to our professional programs. For example, students who wish to develop research capability rather than enter general practice as we have known it, plus those faculty whose primary interests are in research, have been frustrated by the lack of opportunity to specialize because of being intermixed with our professional program. I believe that a clear definition of objectives for substantive study rather than professional training will permit us to improve all of our programs. For a large school one of the advantages among the many disadvantages is that we can be more pluralistic, we can pursue several objectives at the same time. The objectives should be improved study for each student regardless of his career preference rather than a judgment as to what kind of program is most important.

The first questions we asked in considering an advanced graduate program were: Can we get qualified students and do we have qualified faculty? The Berkeley campus certainly has a reputation for graduate study which is enviable, but our own department has not ever shared in that reputation and we were quite concerned as to whether or not we could draw the very best students. The other major question was whether or not the campus as a whole and in particular those departments upon which we would be most dependent were interested in helping us become started in this endeavor. As Robert Geddes has said, "You can't go it alone." With respect to outside departments, it isn't necessary to have an entire department's approval, but it is crucial to have individual faculty members in other departments who are interested in working with your students -- faculty who invite students into their graduate course work even though their background may be different than that of their own majors, faculty who look forward to working with students in architecture in their field as well as working in our field part of their own time. This has been slow in coming and I wouldn't say that this situation now holds on the Berkeley campus. However, each successive year has found a little better relationship between our own faculty and that of other departments and our students are being welcomed into more and more parts of the campus. About a year ago one of the professors in sociology came to me and said they were going to start a new general social science's course. He wanted to know what time I thought would be a good time to have it. I said, "That's very nice, why did you come to me?" He answered, "Well, it's really important to me that we have architecture students in the program." This was an indication that architecture students are being thought of as a group of people who can make contributions in other fields, people who are sought after for programs outside of their own department. It is a necessary precursor to inter-disciplinary work. It is also crucial that we have good scholarship within our present undergraduate and graduate programs; presently this is only partially true. Like most big schools we have some very fine students and some very fine scholarship, but we probably have some of the lowest level scholarship that you will find anywhere also. Certainly we do have some exceptionally good work to build upon and one tends to try to look only at the bright side.

The faculty was our prime concern. We have some very bright people; a lot of people who have concerns which are current and seem relevant. (Regarding Bob's earlier remark I would like to debate Geddes sometime as to the difference between participation and active involvement as opposed to scholarship for I believe they're both necessary, but they're not necessarily the same.) We really were dubious, and still have reservations in some fields as to whether or not we have the faculty capability to mount an advanced graduate program. We have several Ph.D's who are outside of the field of architecture, but the fact remains that if you're going to introduce theory and research method from other disciplines into the work of our own field, then you must have faculty capable of challenging scholarship at this depth. Certainly some of the amateur involvement with other academic disciplines which I see going on in architectural schools like ours makes me very nervous. The very fact that you're willing to participate in someone else's field doesn't necessarily mean that you have the right to be there. I'm very much concerned as to whether or not we have faculty with anything more than just the desire to involve or encourage student involment somewhere else. Do we in fact have faculty with sufficient depth of knowledge to offer the intellectual challenge which is necessary? We are able to locate a few of these people, but like most architectural schools our ranks are thin. I think some of our professional faculty can ask interesting questions, but really aren't able to judge whether or not the application of work in other fields is necessarily well done or considered. If you are tempted to say that the graduate program which relates to other disciplines will depend entirely upon other fields, one must ask the question: why doesn't the student do his work in that field where there are faculty who are qualified to make judgments and considerations.

Our faculty has talked about the general objectives of our advanced graduate program for some time. I'm going to try to reflect our faculty's views and not just my own, although my personal bias will no doubt show. We first questioned whether or not the purpose of this program was to increase the capability of a student for general practice. After much debate we decided that this was not the purpose of the program. With some reasonable humility, we decided that at this point in time we weren't convinced that three to four more years in our departmnet or on our campus would necessarily increase the general practitioner's capability more than the same amount of time in the best offices which are available. We did decide that there was a demand and need for specialization of study and the development of research capability. (Like most faculties, we are responding to the spur of our own students, for most program improvements happen several years after the students have recognized their need.)

We were convinced that there was a need for greater breadth of opportunity in those peripheral areas which involve our field of architecture and for greater depth in sub-fields within architecture. (I speak of the field of architecture rather than the profession of architecture because I think they're quite separate.) We were also concerned about the choice of a degree. We went through the usual argument about Doctor of Architecture and Doctor of Science and the Ph. D. and decided that we really did want the Ph. D., partly because of the prestige that is brought within the university community, but also because that degree did reflect our true intent, that this was not further professional study as such, that the study was for scholarship and research. On the Berkeley campus the Ph.D. is guarded very jealously, and I for one look forward to the kind of challenge which the advanced doctoral programs will face from outside the department and from the Berkeley Graduate Division. I rather welcome some of the constraints which are a necessary part of the Ph.D. program on our campus. You can view these constraints as either being too limiting for innovation, or you can view them as being a rather healthy set of guides for a field which is making its first adventure into advanced education.

For some time we had a committee to study the possibility of an advanced degree program, but about a year and a half ago our tenure faculty placed the development of an advanced degree as the highest priority within our own programs. I loaded the committee with people I felt were concerned about scholarship and would give this their prime consideration. Sami Hassid, Ph. D. in Architecture, served as co-chairman with John Burchard, former Dean of Humanities at MIT, an architectural historian whose education was in architecture. The other members were Richard Meier, whose Ph.D. was in chemistry, but as most of you know he has been ranging through both the physical and social sciences in the last few years; Richard Seaton, Ph.D. in social-psychology on our faculty; Christopher Alexander, who has his Ph.D. degree in architecture; and Spiro Kostof, whose Ph.D. is in art history. This group formed a vigorous committee, and it was no coincidence that almost all have doctoral degrees. This was a symbolic gesture to some of the design faculty that, in fact, this was not their program. You can argue as to whether this is narrow-minded, but the committee did offer us a range of concerns covering those areas which appeared most promising for advanced study. Alexander in particular was very much concerned about architectural design, and the others were concerned with either the humanities or the physical or social sciences. The committee had a student representative and spoke to prospective students learning of their interest in the program. The committee also spoke to faculty members in other departments about their willingness to be involved. I think generally we had a good, wide participation in the development of the structure of the program itself.

The committee's first efforts were directed toward predicting where these students might be useful in our society and in the building industry. The committee then worked backward toward the development of programs. This method was finally abandoned for this sort of "training" notion of the doctoral program seemed to be the reverse of what the true intent of the program was to be. The committee then started over, and decided to work from the students forward, starting with the teachable disciplines and building forward. This, essentially, is what our program now reflects. I believe that these are the two most important ingredients: First, how do you build upon the capacity of the students that you can attract? and second, are you offering work for which there is actually a body of knowledge and which you are qualified to offer? Are you being honest with yourself as to the nature and the range of programs in which you are qualified to participate?

The most argued question within the committee and the one which had the most heated argument in our own faculty was whether or not the program ought to be discipline-oriented. The majority of the committee proposed a Ph.D. program with major fields which were essentially related to sub-disciplines within the field of architecture as they related to bodies of knowledge outside the field of architecture. These programs would involve a field in architecture related to the social and behavioral sciences, the history and philosophy of architecture, and design theory and method. These were the strong recommendations of the majority of the committee. However, a minority of the committee and some other members of our faculty believe very strongly that architecture represents one of those unique fields which attempts to bring together problem-oriented solutions and that this is what the center of our program ought to reflect. This group was opposed to establishing any recognized major fields, preferring instead that each student design his field related to the problem he wished to attack. These two points of view were really not reconciled. And at this point I'm certain that you would find that within our own faculty these two different approaches would be argued very strenuously.

I'll reflect a little bit of my own bias and say that I believe that for the sake of the planned growth of the program, it's essential that we have some discipline-oriented understanding within our own faculty. At this point in time it's very difficult to recruit faculty from outside our own field, and yet it is crucial to have people in our program whose primary education was in another discipline, but who is doing research which bears upon our field. If you have no idea of the disciplines required for your program, then it's rather difficult to gather any strength of faculties such that you can represent yourself to the students as being prepared to offer a program in one area or another. Although all of our faculty like to think of themselves as being generalists, the fact remains that most of them have areas of competence which do fall into one or the other of the rather broad designated areas. When considering the recruitment of new faculty, as well as the need to tell the prospective Ph.D. student where we believe we have competence, it does seem necessary to assess our present faculty and to know where our strengths lie. These strengths will permit discipline-oriented programs but are also essential to problem oriented programs.

The faculty finally accepted the necessity for describing discipline-oriented program but with the qualification that it would consider student proposals for special programs which do not, in fact, fall within one of these sub-disciplines. Our faculty could only consider sponsoring students in programs where we have the faculty competence required. In the design of special programs there lies a difficult philosophical issue: How do you provide the opportunity for the student to create his own program such that it offers him the greatest challenge and yet at the same time assures that he will not avoid those areas in which he has the greatest weaknesses? If you have strong discipline within the faculty, and you have faculty who are well versed in the fields in which the student is going to do his own research, it's reasonably easy through the qualifying examination and other evaluative procedures to set the kind of disciplinary hurdles which will require the student to go back and spend a year or two doing course work and reading in another field because you feel he's just not qualified to attack the problem that he has for himself. But at this time most architectural faculties are not overly experienced in this kind of evaluative process and there are many problems in designing it. Our faculty has to face the problem of how it will set scholarship standards for programs where essentially no established sub-discipline is defined.

With the question of established sub-disciplines as opposed to new innovative combinations, we face our most difficult problem. Are we in danger of embracing the Ph.D. degree at a time when it's falling into ill repute in other disciplines because of its narrowness? I think we have to be careful that we don't take all of the worst parts of the traditional Ph.D. and not recognize that some of the other fields are trying to find ways to make their programs broader. At the same time, architecture has little history of depth of study in any of its sub-fields, and we must not mistake superficiality and selective skimming for broadness.

Even the best students have some tendency to avoid their areas of weakness or areas which are uninteresting, though relevant. We find this in our present Master's program where there is a constant argument as to what extent the student should select his program as opposed to what extent "papa"-faculty really knows better and should outline the recipe of course involvement. There is a dilemma as to whether or not you have a safe program that the faculty knows how to evaluate or whether the faculty can be as inventive and imaginative as the student in its evaluative procedures for examining new programs. This is an issue which we must face in all of our graduate programs and not just at the Ph.D. level, but it's coming rapidly in the professional program where we are trying to include far more things than any one man can ever do.

The objectives for architectural education which the previous speaker has spelled out are marvelous and difficult to refute, but I don't know any man of 50 who can meet them, let alone a student who is getting his Master's degree. In any educational program you must decide where you put your priorities. You have to decide how you can measure what future capability means rather than just past accomplishment. This question of priority relates back to our discipline vs. problem of dilemma. Certainly the student who is problem-oriented may or may not actually meet the university demand that his Ph.D. dissertation must be a contribution to knowledge. There is also a strong question as to whether this person has developed substantive knowledge or methodological skill commensurate with the intent of the Ph.D. At the same time, programs which become so subdisciplined that contribution to knowledge means working on a piece of minutia that really doesn't matter to anyone is not the future that we espouse. So, we really have to be careful as to how we solve this argument.

It was interesting that during our faculty's discussion when we talked about problem-oriented programs as opposed to sub-discipline programs, some of the professional faculty (and I hasten to add some of them) immediately saw that as really meaning that here was the chance to do design projects at the Ph.D. level. It is my personal belief that we must not let this happen in the near future in the program; the purpose is not to do a design project at a slightly higher level, the student can do that in practice very well. I see no reason for the student doing something at the university which he can do better in practice. In practice he can earn a living and perhaps solve some real problems. But, I do believe there is room for problem area programs where the student brings new sub-disciplines to bear on a particular problem area.

In order to bring new disciplines outside of architecture to bear upon our field our Ph.D. program will require two minor fields of study as well as the major field. A student who is a candidate for the Ph.D. in architecture will have to demonstrate competence in two other fields at the doctoral level, one of which must be outside of our college. Whether the field be mathematics or operations research, if this is his bent, or whether they are fields in the physical sciences, will depend upon the individual's own interest for the fields must bear on and be relevant to the area of the dissertation.

I believe that there's significance in the fact that you do not expect a student to know a little about a lot of fields, but to have sufficient depth in selected related sub-fields to advance the discipline in the area of his dissertation. There is a danger about knowing a little about something and yet not enough to understand how little you know. The requirement for minor fields means that the student must become familiar with the literature in that field, to become familiar with the current issues which are involved in that field and the theories and methods prevalent. We will expect the student to bring the capabilities of this sub-field into the theoretical work of his dissertation.

The committee and the faculty covered all of the usual arguments about language requirements which are generally being argued on our campus for all Ph.D. programs. We have been willing to accept the graduate division's normal requirements for language in order to seek acceptance of our Ph.D. program. A reading knowledge of two foreign languages is normally required except that advanced work in mathematics or statistics may be used in lieu of one language, provided that this work cannot also be used to satisfy one of the minor fields of study.

The faculty argued at some length as to whether or not we should admit students who did not have a professional degree. It was assumed at first that most of the candidates would come out of our professional program. But as we talked about it more, it seemed very important that we permit students to enter directly into this program from fields outside of architecture. As a result, we have presently a complicated set of rules which requires extra work from the student new to the field to insure that he becomes sufficiently knowledgeable about the field of architecture that he know the issues and problems involved.

As part of this consideration the entire committee expressed the wish that all of our Ph.D. candidates should have some design capability, or at least first-hand knowledge of the architectural design process. This view was accepted by the historians as well as the behavioral and physical scientists. This doesn't mean that all must be capable of winning competition awards, but it does reflect the philosophy that we believe the design process to continue to be the central issue. Research in related fields is for the purpose of assimilation into the design process and that thereby its value is measured. This agreement, even from our historians, was a surprise but a satisfaction to me. It represents a recognition of the specialist and of research in many directions but all toward the single primary emphasis of seeking a better environment through design.

At this point in time the department has a reasonable chance of being granted this degree program by our Graduate Council. We've been working on it for about two years in some detail, and we had been talking about it before that. However, we still do not have the approval of the Graduate Council on our campus nor the University-Wide Coordinating Council all of which is required before a department can offer an advanced degree. It is my hope that we will be able to inaugurate the program before the end of this academic year.

In spite of our now seeking approval, let me tell you some of the areas where I believe our program is still undeveloped. I am concerned because we do not currently have enough faculty engaged in on-going research. In spite of the fact that we probably have as much research effort as most schools, we are still weak in terms of not being able to offer our Ph.D. candidates strong meaningful participation in research programs under the direction of qualified, experienced people. The research efforts in architecture are marginal at best, and although we have some notable exceptions, we do not yet have the support for research which permits the kind of funding essential for Ph.D. programs. This is something that we will have to correct before we can offer the kind of Ph.D. programs which we envision.

The second area where we have been negligent is in our consideration for the pedagogy of teaching. If most of our Ph.D. students are to find their way into areas of teaching, our program as currently envisioned does little to insure that they will be any better teachers than we. They may be better researchers and better scientists, but if we will be providing people for teaching, I'm not certain that we've considered that aspect of their experience very well.

Another major problem for us because we are a public institution, is that we have very little scholarship money. For years the university has been proud of that fact that it offers almost free education, the tuition being very low. Presently there is some shaking of these hallowed precepts, but it is still relatively inexpensive for the student who is a native of California. An advanced graduate program cannot draw from only one's own state, and for the out-of-state student or foreign student, it is as expensive to attend California as the more expensive private institutions. Most of the other departments on the Berkeley campus, particularly the physical sciences and engineering are highly dependent upon extramural funds to support their own research efforts and in turn, through research assistantships, support their graduate students. Senior faculty in these departments are expected to attract enough research support for their own projects to support three or four Ph.D. students. This is a kind of responsibility that architecture faculty have never thought about. They are not very proficient at fund-raising, and there are few funding agencies.

I believe there are several things of which you should be mindful as you consider programs for advanced graduate study. First and most important, you are making a large commitment to the students. The doctoral student isn't as free to come and go as your undergraduate who can move around every two or three years. This is also true for our Master's programs which tend to be reasonably short in length; but in the Ph.D. program the student will not find it easy to move from one university to another. He's committing three or four years beyond his first degree. If he must teach part-time, it will be longer. You must make a commitment to the student that you will, in fact, have the necessary depth of faculty in his field over this entire period of time. You have the further responsibility to try to find some measure of support for him, or else you're going to be providing this kind of education for only a very small segment of those who will qualify.

There are no morals to tell. This may give you some idea of the issues which we've tried to discuss and some of the choices we have made over the past several years.

As we go to press, we hear that all the approvals have been obtained and the program will be a reality. Ed.

Chapter Three

SOME COMMENTS ON THE PRESENT STATE OF MEDICAL EDUCATION IN THE UNITED STATES

by John Bowers, M.D.

Frequent reference has been made to the progress in medical education following the publication of the Flexner Report and the development of scholarship and research within the medical schools. Dr. Bowers, whose background in the field is extensive, was asked to present to the Chicago Conference some of the insights to be gained for architectural education from the experience of medical education.

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It is fair to say that medical education in the United States today is the longest, the most scientific, and the most expensive system of medical education in the world. Many people would say that it is the best. Certainly since World War II the United States has emerged as a leading center of medical science with a strong program in medical education. We produce physicians who are as well educated as any other country. However, this has not always been true. In the nineteenth centry many people said with accuracy that the system of medical education in the United States was one of the worst in the world. Our educational programs were largely in the hands of physicians who were deeply involved in the practice of medicine and for whom the operation of a medical school was a means of making money. We were dominated by the proprietary medical schools. In these, the sole emphasis was on training (one could hardly call it educating) men to practice medicine. Medicine was quite different in those days because there were rather few things that a physician could do. We did not have insulin; we did not have penicillin; we did not have the adrenal steroids. Anesthetics were hazardous. About the greatest thing a physician could offer in many circumstances was his presence. One reason why there is criticism of the medical profession today is that doctors do have a great deal more to offer than their presence. The importance of his presence has been lost sight of by the physician because of the specific things he can do now which will in many instances promptly cure a disease.

The advance of medical education in the United States began towards the end of the nineteenth century, and this coincided with the emergence of Germany as the center for medical science in the world.

In the sixteenth century medical educational leadership in the world rested in Italy, particularly in Padua and Bologna. It then moved across the Alps to Holland where Leiden emerged as the center of medical education and medical science. Then the center moved to Paris where the great hospital-based clinical schools took over and until about 1830 Paris was the center of medical education in the world. Then the Germans decided that science must become the base of medical education and great basic science institutions began to spring up in Berlin, Goettingen, and Munich. Soon German medical education, with its very strong scientific base, emerged to a position of world leadership. It was only natural that Americans should go to Germany and Austria for their postgraduate studies after they had completed their medical training. They in turn brought back to the United States the German program with a strong science base, which was quite in contrast to the emphasis on clinical bedside training in England and in France. The first medical school in the United States to establish a strong science program on the German style was Johns Hopkins. Our clinical teaching is based on bedside clerking adopted from Britain.

In the early twentieth century,the American Medical Association and private philanthropy became concerned over the low state of medical education because there were just a few schools that one could describe as first-rate medical schools. The Carnegie Corporation commissioned a school teacher from Kentucky who had never, I dare say, been in a medical school before to make a national study of medical education. His name, as many of you know, was Abraham Flexner. He had just returned from a fellowship in Germany, where he had written a highly critical book on the American college and the American university. He came back to New York looking for something to do and Henry Fritchet who was the President of the Carnegie Corporation persuaded him to make this study of medical education. I emphasize the fact that he had probably never been in a medical school because he came with no baggage, he came with no commitments and I think this was one of his great strengths beyond his keen, highly analytical mind.

Flexner had absolutely no commitment to medicine. He had no attachment, and he could fire his guns without any concern about lsoing his membership in the American Medical Association or a state medical society or being attacked by his brethren. In 1913 Flexner published a report which has been described as the most important single document in the advancement of education in the United States. Certainly it was a landmark, and I dare say that it did have a greater impact on medical education than would be true of any document in any other segment of higher education. Soon after the Flexner report was published, within a period of three or four years, more than half the medical schools in the United States went out of business, and those that remained set themselves on a course to upgrade their educational programs.

Since you are concerned about changes in education in architecture it is fair to point out that the Flexner report in 1913 would never have had its impact had there not developed at that time an organization called the Rockefeller Foundation. A Baptist preacher named Gates was a confidant of John D. Rockefeller, and Mr. Rockefeller was besieged by missionaries and ministers, soliciting his money and so he turned to the device of establishing a foundation. Gates, the Baptist minister, read Osler's textbook of medicine and decided that the Rockefeller Foundation should do something in the field of medicine. Just at that time the Flexner report appeared describing the, one can really say, miserable state of many of our medical schools so the first big thrust of the Rockefeller Foundation was to hire Mr. Flexner and to make available funds to cure the diseases of medical education that he described in his report. The availability of the Rockefeller Foundation money which Flexner could use to cure the deficiences described in his report, was a vital force in upgrading United States medical education.

Medical education in the United States continued, until World War II, with relatively few schools involved in developing a strong scientific base for medicine. There were relatively few schools to which a man aspiring to a scientific career could turn to find the equipment, the laboratories and the scientific guidance which would give him an opportunity to develop as a medical scientist. There was the adage that if you were looking for a good scientist to join your medical faculty before World War II you went to the Johns Hopkins Medical School or the Rockefeller Institute, because these were the two institutions where medical science was flourishing. One can say that of the about seventy medical schools no more than a dozen really had medical science as a strong part of their program.

Since World War II, with the tremendous amount of money that has been poured into medical research through the National Institutes of Health, one can say that today in every medical school in the United States there are active, vigorous medical research programs. This has been one of the great benefits of the influx of federal money. It has spread opportunities to do medical research across the country so that it is no longer necessary for a man to go to the Rockefeller Institute or Harvard or Hopkins to do research. In every medical school in the United States now a worthy man can get support, can develop a laboratory and can work in medical science.

I shall review for you briefly the system of medical education in the United States today. Practically all of our medical school applicants have completed four years of college and there has been a strong move in the last fifteen years away from "premedical" education towards a greater emphasis on liberal arts education. It is true that the college program of a prospective medical student is still dominated by biology, chemistry, physics and mathematics. Under the old system, a pre-medical student took eight or ten courses in biology, many of which were very poor introductions to the courses that he would take in medical school. In general a premedical student will take courses in general biology and comparative anatomy; general chemistry, quantitative analysis and organic chemistry; modern physics and mathematics through trigonometry. Then we push hard for an emphasis on general education.

The medical school phase occupies four years and one can divide it arbitrarily into two segments. There are two years which we usually refer to as the basic science years and in these the student studies anatomy, physiology, biochemistry, bacteriology, pathology, pharmacology. Since World War II there has been an increasing tendency for these courses to be taught by men and women who have not graduated from medical school but who come to medical science with the Ph.D. The last two years are concerned with clinical medicine. The medical student dons a white coat, puts a stethoscope around his neck which gives him a great sense of pride and he feels and acts and we hope thinks like a doctor. He learns at the bedside and in the clinic. The emphasis is on the ward and the patient with the lecture hall as the introduction to high points. He studies medicine, surgery, pediatrics, obstetrics, psychiatry and other specialties. Then after a total of four years of medical school the young doctor is required to take a one year internship. Almost every graduate spends at least one additional year in residency training after the internship. These residencies are in special fields such as pediatrics, obstetrics, surgery -- at least one year but increasingly the residency period has extended because each speciality feels that a sign of its importance is to have a long residency training program. Frequently the length of this residency training program does not relate directly to the relative clinical importance of the field. There is an unfortunate imbalance which to many of us simply doesn't make sense. It is true that one of our weak spots in medical education in the United States is this constant extension of specialty training. Each specialty is run by what is called an American Board; these are autonomous, self-perpetuating groups. There is no effective central body for coordinating the efforts of the American Boards; each goes its merry way adding another year, adding another year. People often criticize the medical schools as the focal point because of the length of medical education in the United States. A great deal of the fat is in residency programs.

If a doctor wishes to be a medical scientist, somewhere along the line he will spend one, two or three years in a fellowship working in a research laboratory. A majority of the physicians who lead our programs in medical science and who are the leading teachers and scientists in our medical schools have not gone through the Ph.D. training. They go through the medical degree, then some or all of the training that I have outlined, then spend several years on fellowship but they usually do not bother to seek a Ph.D. degree.

One of the interesting developments since World War II in the medical schools has been a greater emphasis on basic science research not just in the basic science departments but also in the clinical departments. Frequently there are more biochemists in the departments of medicine and surgery and pediatrics than in the departments of biochemistry. A great deal of the biochemistry and microbiology is taught in our clinical departments. The importance of the basic science departments in medical education in the United States has, in the eyes of many, been dwindling steadily to a degree where the basic science departments now orient towards the basic sciences in the university college. There is concern that the polarization of the basic medical sciences towards university disciplines and away from medicine may lessen their relevance to medicine.

As medical science in the medical schools has expanded, so too has our knowledge of opportunities to cure disease, our opportunities to keep people healthy. As far as the medical schools are concerned, the great scientific impact since World War II has been all to the good. I am conscious of the criticism that is leveled at us that we have stopped training general practitioners. I would say in defense of this position that it is simply impossible for any one man to do everything well in general practice today. If we include surgery, obstetrics, pediatrics, internal medicine there is just too much for any one man to do it all well.

Many of you have asked questions about the methods by which these advances were made. Let me give some examples. Before World War II there was a National Cancer Institute as part of the United States Public Health Service. It had laboratories in Boston and in Washington. After World War II the National Cancer Institute grew very rapidly. This relates in part to the fact that several of our leading legislators died from cancer and this aroused considerable congressional interest in cancer. Then a very wise decision was made to set up study groups from university faculties who would be responsible for recommending to the United States Public Health Service how money should be spent on requests from institutions or individuals. This has been a most important approach for it has brought the scientific community in a direct advisory capacity to each institute. Beyond the study group there is also a council in each of the institutes -- there is a National Advisory Cancer Council, for example -- and the recommendations from the study group, let's say, on bladder cancer or lung cancer, then go to the National Advisory Cancer Council. The National Advisory Cancer Council includes nonmedical as well as medical membership. One of the most effective lobbies in the United States has been the cancer lobby. One problem is that the funds that NIH have escalated at times beyond the capacity to absorb them wisely in good scientific research.

The men who form the study groups are almost entirely men and women who are members of medical school faculties. There would be very few instances where a practicing physician who was not on a medical or university faculty (I should't say exclusively medical -- there are engineering people involved, basic sciences, etc.) but I would say that the control is in the universities primarily in their academic medical centers.

The big push generally has been on basic and fundamental studies and this has been the major activity of the research establishment. On the other hand, there has been a very active effort in application of the basic knowledge to the bedside, diagnosis and treatment of disease. We have large drug testing programs. There has been a great deal of development in the field of radiological diagnosis. We are constantly improving laboratory procedures using smaller and smaller amounts of blood for getting more and more information. A number of the major medical centers have large computer centers for the diagnosis and treatment of disease, for codifying information, and for research. I'd say there has been a great deal of activity in improving diagnostic and therapeutic procedures. Today, the thrust is on application so that in the years ahead, I'm sure that the major investment of federal money is going to bend increasingly towards application.

There has been very little research on medical care. Two years ago, several foundations decided that we would like to invest some money in medical care. There are only about two or three teams in the United States, that I know of, who are really capable of doing good research on medical care. This is an area where we are deficient in people and where economists and sociologists are becoming interested and hopefully will move in to do some of the studies. It is an area which physicians have neglected.

Such studies are usually based in departments of preventive medicine, with a background in public health and a concern for how disease affects groups of people. The laboratories that are used may be community hospitals. Medical care delivery systems in the United States have been compared with other countries. In one study, medical care delivery systems in the United States, Scotland and Yugoslavia are being compared. The laboratory in general is a community. It may be the dispensary, the clinic in the university hospital, a community hospital, a health delivery insurance system. The use of the university hospital for studies on medical care has been greatly neglected and it is particularly unfortunate because it could represent a laboratory where people representing not only medicine but economics, sociology, a whole constellation of university interests could work together. The university hospital has been little explored as a field for studying medical care.

I am asked whether the psychologist and sociologist are going to come to medicine or medicine is going to have to go out and interest these people and bring them in. I think it is going both ways. After all, something over two hundred sociologists register themselves in a branch of the American Sociological Association which is called Medical Sociology. Sociologists are interested and involved. In economics this is just beginning. The Department of Economics at Harvard is working closely with the Harvard Medical School. There is an excellent program at the Brookings Institution in Washington led by Raschi Fein, who is an economist who has been interested in medical economics. I say that in general the thrust is coming from economics and sociology.

As to the extent to which medical education in this country really can be described as the system of education, I noted three phases: the medical school phase, the internship phase, the residency phase. These do offer continuity in the sense of system. On the other hand, let me go on to say that the four years of medical school are essentially controlled by the university. This is university-based medical education. The medical schools are periodically accredited by a joint program sponsored by the Association of American Medical Colleges and the American Medical Association. A team of three to four men will spend three and one-half days visiting the departments, talking with professors, the dean, the university president, then reporting to the president and the dean on their findings. It would be most unusual, I would say, for an accreditation team to leave without having some criticism.

Unfortunately, the internship phase is under completely different control. The internship phase is controlled by the House Delegates of the American Medical Association and their primary concern is service. They want interns to examine their patients and they are always worried about the numbers game, about having enough interns to do their work. That is why we have 3,800 Philippine medical graduates serving internships and residencies in the United States and something like 1,800 Indians. Then we come to the residency phase and here the shots are called by the specialty board. Most of the members of the specialty boards are from university departments. But when they leave the campus they forget their university relationship. They become solely devoted to their specialty. We have a loose system -- three phases each controlled by a different group with a different philosophy and a different attitude.

One of the great problems before World War II was that we had full-time medical students and part-time teachers and that in many instances, certainly in most of the medical schools before World War II, the faculty members depended upon private practice for their income. The great thing after World War II was that research money helped establish full-time teachers and scientists who could then devote themselves more effectively to a better job of teaching. Coincidental with this tremendous flow of federal money there was the rapid development of full-time faculty in the medical schools so that they were able to do a much better job in teaching than had been true in the past.

I would agree that, while part of the support for medicine comes from the natural understanding by a human being of what illness is and what medicine can do, at least part comes from the operations on such special purpose organizations as those on cancer and infantile paralysis that catch the public eye and the conscience of the legislators. I would like to make one other comment about what organizations such as this can do to improve educational processes. We have a very active organization in medical education called the Association of American Medical Colleges. Beginning in 1950 we set up a program of so-called teaching institutes which contributed greatly to the revitalization of medical education in the United States. These institutes were held annually; they began with the basic sciences; one or two representatives from each medical school participated by invitation; the focus on what we can do to improve education was central. I think that the teaching institute pattern could be very well considered by this organization as a possible approach to what we are all trying to do and that is to constantly review and revitalize our educational programs.

Several educators and administrators were assigned responsibility for a teaching institute on, as an example, biochemistry, physiology and pharmacology. These three fields were the theme of the first teaching institute. We then set up committees of leading teachers and scientists in these fields to plan the institute. We developed a list of leaders in the faculty of each medical school and invited them. We had position papers prepared and presented and there was a great deal of emphasis on small discussion groups. These usually lasted for four or five days at the end of which in due course a book was published setting forth the challenges and provocations. I think every faculty member who attended one of these institutes went back sparked up and wanting to review and revise medical education. Usually he reported to the faculty and helped to spread the cause of ferment in education. Over a period of six or seven years we went through the whole medical curriculum -- basic sciences and clinical sciences. These teaching institutes will stand as real contributions to the progress of medical education.

As for the role of practitioners in teaching, I think that the practicing physician can bring in examples and contacts and his own experiences which are very useful. It is fair to point out, however, that the so-called "full-time" faculty members continue to take care of patients. One of the adverse effects of the move for full-time faculty has been to bring out very serious town and gown problems in many institutions where the practicing physicians with some justice complain bitterly about competition from the members of the medical school faculty.

In some institutions all faculty members are really full-time. They may continue to see private patients but the revenues go into a central fund and that fund is used in part to pay their salaries. In a number of the medical schools, faculties are on what we call "geographical full-time". That means that they receive a salary from the university and are permitted to add increments which are usually based on their faculty rank. Any money that they take in beyond that ceiling goes into a fund which is used for departmental development. They also contribute to the academic medical center for the use of the facilities in their private practice. The "geography" is based on the fact that we require that they do all of this in the teaching hospital. They cannot go out in the community to do it.

One of the big problems for the medical centers now is what to do about the money that is going to come in through the Cancer, Heart-Stroke programs, and through medicare and medicaid. This is going to build up considerably the incomes in the clinical department so this is another problem. In several institutions the clinical departments already have voted to "split the take" and to give a significant percentage of it to be used in raising the salaries of basic science faculty.

In curriculum development, the name of the game today is "electives" and the push is towards having one or even two years completely elective. Heretofore, the curriculum was stuffed for four years in most institutions but there is the big push today towards squeezing down the entire teaching to three or two and one half; at Duke now I think it's two years. Of course it's always a problem: you free up a lot of elective time and the faculty moves right back into the elective time again. But you have a temporary reprieve for a while anyhow.

You ask about community medicine. One of the most interesting studies on medical care was done by Dr. Oster Peterson in North Carolina in the 1950's when he gained access to doctors offices and watched how they practiced medicine. He was in the laboratory and I think observed about eighty physicians. This is one approach. It is for a brave observer to try to evaluate how effectively a doctor practices medicine. Some things can be checked easily: whether or not he takes the blood pressure, whether or not he has the patient unbutton his shirt when he listens to his heart, whether or not he examined the abdomen if the patient complains of pain in that region.

Another approach is to study the incidence of various diseases in occupational groups. Another, and a great effort has been made on this, is the whole area of mental health. One of the problems comes from the facts that much of this work has been done in the schools of public health. The development of schools of public health has perhaps unwisely been separate from the medical schools. This became another force in disengaging the doctor from a concern about the delivery of medical services and emphasized the entreprenurial system of medicine which we have and which is a very difficult system to evaluate. Basing it all on the individual, you really don't have a system to study.

In conclusion, from the standpoint of medical schools, we endured a long period when the focus was solely on teaching the tricks of the trade. How to make a diagnosis in a hurry, give some aspirin, codeine, laxatives and so forth -- we taught "cook book medicine". Then, beginning at the turn of the century, there began a slow development of science in American medicine which had a limited impact until World War II. The American public became sold on medical research as the cure-all and I think one of the decisive events in this, of course, was the development of the vaccines to prevent infantile paralysis. I think this had a tremendous public impact in relation to medical research.

Now we are entering a phase, as many of you know, where the emphasis is swinging towards the application of the new knowledge. Through the new medical care programs, particularly those of the government, we are swinging towards a phase where we are going to be deeply concerned about the deployment, the application of medical service. Medicine in the United States today for the wealthy person and the upper middle income person is the best in the world. For the lower economic groups, thirty million in all -- poor whites, the Negro, the Puerto Rican, the people in our urban ghettoes -- medical care in the United States is inadequate. I am heartened that we are going to keep the research base but will add to it a greater emphasis on medical care.

Chapter Four

OBSERVATIONS OF AN ENGINEERING EDUCATOR

by Benjamin Nichols

Engineering education has in recent years faced many of the same problems as architectural education. Professor Nichols has been intimately associated with some of the most forward-looking developments in the field, and he was asked to present to the Chicago Conference some of the insights from this background that might benefit architectural education.

Benjamin Nichols is Professor of Electrical Engineering and Acting Chairman of the Center for Research in Education at Cornell University.

Let me start by saying that in listening to the discussion yesterday I felt that much of what was being discussed had a very close relationship to the problems that engineering education faced immediately after the Second World War. It all sounded quite familiar; at least it seemed that way to me. Perhaps many of you are not aware of the situation. Although graduate education had existed in engineering for many years, at that time it was very restricted. A small percentage of engineers went on to graduate education, and in fact in most colleges of engineering there were very few faculty members with Ph.D.'s.

The undergraduate program for preparing engineers was based mainly upon an empirical and what was then called a "design" approach. The word design at that time meant following established practice. The result was that during the Second World War, when it was necessary to initiate new developments that were not based on previous practice (for example, the development of radar, new antenna designs, and microwave systems), the engineers were simply not prepared. Most of the major engineering developments during the Second World War had to be carried out by physicists and mathematicians who were not really interested in doing the appropriate kind of detailed work. As a result, there were some failures, but some were able to get into a new field, start from first principles, and develop it. This taught engineering education quite a lesson -- at least electrical engineering education. Since our obvious humiliation more than two decades ago, there has been a curriculum revolution both at the undergraduate and the graduate levels.

The major move has been towards education that prepares students for change, that takes as its basic point of view the belief that the practice each student will be engaged in five years after he graduates will be so different from present practice that the important point of his education is to prepare him to be able to function in new situations. This means, from the point of view of the undergraduate, much more science and mathematics than was formerly included. It has meant, from the standpoint of the faculty members, the experience of themselves being engaged in new developments, of being involved in research so that they can both contribute to the field and prepare the people who will contribute. It is possible that you can find some analogy here with the situations you are discussing. In the current problems of urban development the feeling seems to exist that people in system analysis are the people who are prepared to undertake these major new tasks. Perhaps architects are finding themselves in a similar position -- or some are -- to that in which engineers found themselves twenty-five years ago.

Secondly, when I heard the discussion about degrees I felt that there was much of a common problem. Engineering feels that it is a profession also. It gives professional degrees, and there is a great confusion about the degrees. There are places that give just a bachelor of science degree as the first degree. Others give a bachelor of engineering degree as the first degree. Over the past thirty or forty years there have been lots of different degrees in the field including recognition for professional work through some kind of a doctorate or just a plain title. The situation is still fairly confused, but I think it is settling down to something like the diagram that was on the board yesterday (from the AIA-Princeton Report) although we haven't thought of it in terms of modules. The basic pattern that seems to be establishing itself is one in which after four years a bachelor's degree is given by the college of engineering. In many places now this is not a "professional" degree. It is a bachelor of science. The first professional degree, after five years, is a master's degree or in some cases a bachelor's degree in engineering with some appropriate specialty attached for example, Bachelor of Chemical Engineering or Bachelor of Mechanical Engineering. There has been established a rather clear-cut difference, then, between those students who will be going directly into practice and who will use this professional degree for that purpose and those students, who after four years, go into a research-based graduate program that leads either to the Master of Science or the Ph.D., mostly of course the Ph.D. degree. It has become a fairly well established differentiation.

Now as to the preparation for the professional degree, there is very little question that those who undertake the fifth-year program are those who have pursued the normal undergraduate program in that field and are prepared then to go on into the considerations of what may be more directly applicable in current engineering practice. On the other hand, for the M.S. and Ph.D. programs there is much greater flexibility in the preparation of students. We have had students coming in to do graduate work in electrical engineering with undergraduate degree in physics or mathematics or in other fields of engineering. There is a very great blurring of the lines. When one considers going on to do original work, there are many patterns of preparation that are appropriate. Graduate schools, if they are truly graduate schools, are flexible enough to fit the program to the individual, rather than designing any specific pattern that is required of all students. Since the postwar growth of graduate engineering education -- which by the way is not yet an unqualified success -- engineering students going on to research work have been making great contributions to their fields.

One of the problems that most universities faced in improving engineering education was faculty development. As I mentioned before, most of the faculty members then teaching had not personally been involved in research. The younger faculty members had only recently completed the regular professional educational programs. In building up graduate work the great problem was how to involve older faculty members in research and in the development of younger faculty members. I might mention one of the patterns developed at that time that you might find pertinent.

A few universities in this country had already developed programs of research in engineering. Rather well-financed fellowship programs became available for young faculty members. They were given leave for a year or two to go to these more advanced institutions. They generally received their normal pay, mostly through the generosity of the Ford Foundation. Thus there was an extensive program for developing young faculty which involved their getting a leave either to complete their Ph.D. degrees or just to participate in the research activities at these few original centers. At the end of the stipulated time, they returned to their own institutions. Under these conditions, there was of course some obligation to come back and contribute to the development of research programs at their own institutions. This takes a few years, but the result I think has been to build up a significantly large number of universities competent in graduate programs.

Meanwhile, if you read the engineering-education journals, the thing that seems to concern many educators today is that in the process of all our expansion of mathematical and physical applications the element of "design" has been lost. Many feel the need to recapture this integral part of engineering education. I think there is a certain sense in which this is true and a certain sense in which it is false. Many people who talk about the loss of design are thinking about it in the old-fashioned sense, in the sense that the student is no longer ready when he gets his degree to specify *immediately every specific design* in terms of current practice, to have all the tables available. That kind of knowledge is very easily obtained in practice, and there is no point spending time on it at the universities, in my opinion. This view has, at least in our case, been accepted by industry.

There is, however, an aspect in which there has truly been a loss to engineering education. Many people are concerned about and are trying to recapture the sense of purpose, of remembering what it is all about; why we're doing it. We have seen the importance of having available to the student programs which have specific outcomes, letting the student get engaged in something which ends up in some product, operation, or system that would actually be used to serve mankind. There has been some erosion of ties with the real world because of the greater emphasis on the science and the need in many cases for development of the appropriate science in the engineering schools themselves. I might mention that when you really get into it you find that, in fact, science itself -- the basic science -- is not prepared with all the answers. There is a wide gap between the "basic physical laws" and their application in complicated situations. Bridging this gap has been the contribution of applied sciences and applied mathematics in the engineering schools. But keeping the ties with the real world seems to me a particular problems in our case, and I would guess in your case as well. The real world problems have become so big that the actual case must be dealt with; the small example is not really relevant. It is hard to simulate a really big system on a small scale. You lose to many of the important elements.

Let me go on then to give another example of a field that I have been concerned with. That is the field of education. I think there are some lessons to be learned there. To a large extent, it has been a horror story, one that you would not want to copy. The field felt that it needed the prestige associated with graduate work. One had to have the title "Doctor." It was the title that seemed to matter and not the substance. If you look at what has happened, you could certainly draw that conclusion. There has been the pattern that anything you take beyond four years is graduate work, and you should therefore get a Master's degree at the end of five years. If you go for a couple of more years you should get a Doctor's degree. Exactly what you are doing, the substance of the work, seems to be less relevant than the fact that you are doing it. There has been a pattern in education of complete parochialism and isolation from the rest of the disciplines, from the rest of the university. I think this separation has existed at most institutions. I'm being a little extreme about this, and probably some of you may know of examples where this has not been quite the case, but I think in general it has been true. The pattern has been, in terms of the doctorate, of preparing people just like themselves to go on to teach other people to be just like themselves, with no real input of new ideas or new approaches. The pattern has been one of looking slavishly at the sciences and saying well, if it is going to be research, it has to look like physics or chemistry. This means that it has to look quantitative, and it has to have controls and statistical analysis. What has been missing is any real insight as to whether any of these projects are relevant to their problems. One finds very careful and detailed studies of minutiae that are never used by anybody. They receive listing as Ph.D. theses in the library and are never consulted by other researchers. Architects are not in the same area, of course we all need to be wary of exercises in research that have no application to the real concerns of the field.

The pattern that we are trying to set up in the field of education -- the pattern that Burnham Kelly mentioned in terms of the Center that incorporates people from all over the university -- also presents problems in terms of establishing appropriate graduate programs. The real need for people preparing to be teachers is to have a very solid preparation in their own discipline. We want to involve students say, from mathematics, or from history, or from psychology, or even electrical engineering, and to have them then approach real problems in education after having the appropriate preparation in their fields. Obviously, that means that we have to have faculty members conducting research and able to guide these graduate students in meaningful projects.

In this complicated real-life field, the problem of generating generalizations that apply across all situations is very difficult. You do not have the freedom that physicists have to choose their problems. The big advantage that the physical scientist has is that if the problem looks unsolveable he does not treat it. The problem of understanding everything is not what he faces. The pattern is one of starting from where you are; you know how much has been developed; you pick a problem that you think you can solve; and you go to that next stage. Occasionally you encounter something unexpected. The people in the applied areas such as engineering, or architecture, or education, it seems to me, simply do not have that choice. The problems exist; they have to be solved now, and you have to do the best you can with the present knowledge.

The problem here is to what extent objective knowledge is pertinent to design. This seems to me very similar to the question: to what extent should the research programs be programmatic, and to what extent based on specific disciplines? The answer we are finding in the fields that I've been involved with is that to capture the interest of the student, and to make the objective knowledge and the disciplines pertinent, you have to have a program as the central core around which you are studying the disciplines or creating the objective knowledge. This cannot be done in vacuo, or it will simply not be pertinent; it will not be relevant. This is the basis of what is happening in the interesting work in education.

By the way, one program that I would certainly like to see a group involved with is the taking of a really different look at schools and the design of schools and how one makes schools in the urban setting a part of the community instead of just separate, cut-off buildings. Involved in that program are the questions of education, and of children, and learning, and perception, and sociology, etc. The best and most analytical results will be obtained if these questions are pursued in terms of this actual problem. The research work will be much more relevant and useful, and in the process we might actually accomplish something.

One of the other lessons that I have learned is the danger of looking at a problem in the educational field and planning to fix it up with one solution across the board. Any worthwhile program will be different from any other and should be different. Each has to be based upon the interest and capabilities of the particular group involved, on the setting and on the group's own initiative. Any legislated change turns out to be just a change in form and not in substance.

An example of an attempt to solve a problem in education by mass approach which has resulted in very little is the creation of the new regional educational centers financed by the Office of Education. The important question is: How does one get the best talents of the universities, the communities, various professions in the communities, industries, and so on together to look at the whole educational problem of the region? This is a very difficult problem, and there is a small number of people in the country capable of really working at this and finding out how to do it. But the Office of Education said that if there is going to be a regional laboratory, there has to be one in every region. They divided the country into fifteen regions and set up a laboratory in each region, none of which is appropriately staffed or financed. Now we have these regional labs, each spending a million dollars a year. Of course, there has been something accomplished, but the developments are meager.

Finally, let me make a few generalizations based upon the whole question of education that I have been thinking about for some years. I would emphasize two points:

(1) A very fruitful way of starting is to say: What kinds of students do I have? What do they really know, not just what have I taught them? What do they know from all of their life and experience, and what would be a really interesting program for them? Once one captures the active interest of the student, one has multiplied the energy behind the program by many fold. One lesson that we have learned from the studies in elementary science is the difference between an active learner, who is approaching a problem he is interested in, and the passive student.

(2) By far the most important goal in education is to develop people who are capable of continued learning and change. That development is not done by teaching a course on how to learn to change, but by putting students into situations in which they have this experience. If the problem is to prepare different kinds of people to work in groups or teams, then in the educational system the students should work as teams, so that the lessons of how one works this out are learned in practice.

One other lesson I have learned is that one can expect very little out of conferences of this kind. But I think they are necessary. The important thing that can come out of conferences is not the large consensus, the compromise statement that almost everybody will go along with. Rather it is the few groups, not just single institutions, who get together and propose a specific program. If out of this conference come a few specific programs, a few consortia, who are ready to go ahead and propose something, then it would seem to me that your time has been usefully spent.

Chapter Five

THE DESIGN SCIENTIST -- ROLE AND TRAININ

by Carlisle P. Runge and Herbert S. Heavenrich

One of the very important avenues for the development of graduate programs of scholarship and research within schools of architecture is that of cooperative action among a number of universities within a region. Professor Runge has been closely associated with the development of an important consortium of mid-western universities, and he was asked to present to the Chicago Conference his views on the nature and benefits of such an approach.

Carlisle P. Runge is Director and Herbert S. Heavenrich is Program Consultant of the Council on Economic Growth, Technology, and Public Policy in Madison, Wisconsin.

About twenty years ago the chairman of your committee wrote some interesting observations about design research within the housing industry:

> We have pointed out that when an entirely new product is developed a new industry will often be created. But houses are not new products, and they cannot quickly be "rationalized". Men may select a radio with a relatively dispassionate logic, but emotions and traditions tend to dominate in the choice of a house. Obviously, careful sociological research is needed even to identify the main drives operating in this field, and much more research will be needed before we know how to direct these drives, or to what ends .... Far more is involved than the tabulation of preferences regarding the size and arrangement of rooms. It may one day be shown, for instance, that satisfaction with a house depends less in the character of the house itself than in the social relationships formed by the family .... Even such broad considerations as full employment and increased leisure will have their influence on the product and on the industry.[1]

You who have the professional interest inthe mission of the ACSA Committee on Research and Graduate Studies are undoubtedly more familiar than I with the history of academic endeavor to forge working links between the "people scientists" and the environmental design professions. You each have your own assessment of the progress made in the past two decades. More specifically, you are able to assess the extent to which such efforts are visible within your own and related curricula.

From what I have been able to gather, the great scientific "breakthroughs" such as called for by Burnham Kelly have not yet been made. As Dr. Robert Charpie, now president of Bell & Howell, recently testified,

> We need to know: (a) what people want from urban life, (b) what resources in total might reasonably be devoted to attacking the urban decay problem, and (c) in broadbrush terms, what, if any, alternatives exist to the present organization of the central city.[2]

Our consortium of Midwestern universities has had a "running romance" with this opportunity area for nearly two years. Prior to this, as Executive Director of the Coordinating Committee on Higher Education for Wisconsin, it was my function to review and gain approval for the Environmental Design Program at the University of Wisconsin, now a full-fledged department.

Perhaps it will be useful to describe our encounters and what we are now preparing to do. Your suggestions may aid our perception of these problems and, in turn, our advocacy of programs that will be of some lasting value to the concerns of this meeting.

Let me briefly describe the context in which we of the CIC Council on Economic Growth, Technology, and Public Policy operate.

The CIC is a loosely kniw consortium of eleven major Midwestern universities -- the Big Ten plus the University of Chicago. The Council is a relatively new creation of the CIC (activated September 1, 1966). It was spawned out of the mutual concerns of the Midwestern governors and the university presidents for the economic and social welfare of their seven-state region: Ohio, Michigan, Illinois, Indiana, Iowa, Wisconsin, Minnesota. The Council mission can be described briefly as follows:

> The university, in accepting its obligation to serve society, has adapted itself to a changing environment. Yet it would seem that the university can do more to influence the nature of its contributions to the society that supports it. With that in mind, the CIC organized the Council to assemble selected resources of the member institutions in interdisciplinary, problem-oriented research and action programs designed to contribute to the long range economic productivity and social welfare of an urban and industrialized society.[3]

Cooperative university efforts for specific projects are certainly not a new idea. However, it can be said that the scope and scale of the proposed Council programs are probably unique in many respects and, therefore, quite experimental. Among other hypotheses that the CIC is consciously testing are:

1) that certain types of problems and opportunities of the region can be more beneficially addressed by cooperative combinations of people from more than one CIC university than by any single CIC university;

2) that the Council can provide organizational mechanisms and incentives more effective at transcending disciplinary barriers to problem-oriented efforts than traditional university organization has normally permitted.

The extent to which this experiment will succeed remains to be seen. Suffice it to say that at this moment in our development we have several major programs in various stages of progress. In order to get into the matter of our initial concern, I will merely state their titles. You will note that there are, intentionally, strong interrelationships between the several programs; or, as one of our early policy papers put it, "one would not encourage the initiation of a large number of unrelated individual studies".[4]

1) Water resources management in the Great Lakes region;
2) Interuniversity programs in urban affairs;
3) The Midwestern spatial system, its management and development;
4) The Midwestern transportation system;
5) The Midwestern climate for technologically spawned, innovative business and industry; and
6) Consideration of a regional economic growth model.

Now we are seeking opportunities within our programs which would help us to address the concerns of the CIC Ad Hoc Committee on Urban and Regional Design.

At approximately the same time that our Council was being activated, the group I have just mentioned -- the CIC Ad Hoc Committee on Urban and Regional Design -- came into being on their own initiative. As several of you know, this is composed of professors of architecture or landscape architecture who have strong research interests at five of the CIC universities. From the beginning, both the council and this committee have perceived important potentials in relating to one another. A few attempts to design and mount specific programs were made in the earliest stages of our development. In terms of initial acceptance by the Council, we failed. These failures have pushed us to a more critical evaluation of what may be involved, including, perhaps, some better sense of limitations imposed upon us by the state of the social sciences, and most particularly, the behavioral aspect.

At this point it would be useful to get more specific about the type of relationships with which we have speculated and, we hope, begun to refine to an acceptable point of program definiton. At our request the chairman of the CIC Committee on Urban and Regional Design, A. Richard Williams, Professor of Architecture and Associate in the Center for Advanced Study, University of Illinois, Urbana, presented a statement of their research needs to the appropriate working group at our recent (January 1968) Conference on Interuniversity Programs in Urban Affairs. I quote portions of his statement:

> As an ad hoc committee of urban and regional design in existence for a year and a half, we feel very

> sharply the lack of a unified and articulate "client" who could enter into dialogue with us, proposing notions of social, political, economic and movement structure of a total urban system to which we may respond with design alternatives.
>
> ....it is exceedingly difficult to formulate on our own the necessary assumptions and program for these experiments and as models, to obtain meaningful criticism in depth. We are here to find the voice that can speak conceptually of the total system, that can describe its hierarchies and can suggest its most viable alternatives of form.
>
> Innovation of a more profound sort is obviously difficult in this system unless the programmer, or client, as well as the designer is willing to accept and experiment with new institutional forms, new patterns of functional relationships and a new sense of public responsibility beyond his own property lines.
>
> Somebody, therefore, has to represent, speak for and be given authority to make enlightened program decisions for the plural client if the resources of the design professions are to be extended to this new dimension. To stimulate this kind of enlightenment in the broadest public domain, a model of its action process could exist in the university or multi-university context. Through its recognized neutral auspices and objectivity, the university is an ideal place for seed action in advocacy programming and advocacy design.
>
> I therefore propose that this workshop define a working model of a plural-client-programmer team, a design response team and a system by which the results of their work together can influence public policy.[5]

Stage I: The "Plural Client" and "Design Response" Teams within Academic Structure

The notion of a "plural-client-programmer team" related in some systematic way to a "design response team" has been the central theme of nearly all of our program design efforts to date.

Conceptually, the client-programmers would be groupings of social scientists and biological scientists reporting known facts, or posing hypotheses, which enlarge the array of "human need": considerations useful to the "design-response" group. Essentially, it is a scheme to preclude design suboptimation at too low a level, a concern expressed by Professor Britton Harris at our Urban Affairs Conference.[6] After noting observations of other groups or individuals working with this type of problem, it appeared that our program concepts needed a greater sophistication.

Stage II: The "Decoder"

After observing a number of serious efforts being made to relate scientists observing and defining human environmental requirements to environmental designers, it appeared that the oft referred to "language barriers" were, in fact, some hindrance to the progress of such work. Here is the entire question of synthesizing relevant design consideration emanating from the "client" group into such form, language, and value assignments as may be beneficially utilized by designers.

An illustration of this problem is contained in a summary statement on a series of seminars conducted by a group of 15 to 20 social scientists asked to contribute their thinking to the designing of a "frankly experimental" city at the University of Minnesota.

> The Social Sciences can contribute both questions, methods, and a supporting literature within the above framework of experiment and simulation. Each discipline is concerned...in some specific way. Each discipline has faculty members interested in questions raised by the Experimental City. The problem is not one of either interest or research time, but primarily one of how can our inputs be assimilated and made operational in the project.[7]

Our concept then added the notion of a specially trained kind of individual, or team, who might perform a "decoding" or "transformation" operation on the information flow between "clients" and "designers". This would seem to require individuals trained to some level (not yet specified) of competence and understanding of social science disciplines, design professions, and enough systems competence to be able to translate, organize, and effect information flows which bring about greater efficiency of utilization and effort by both groups. (In one case that we know of, this function is being performed by someone who is called an "information scientist".)

In our later discussion we identify the people performing these transformation functions as "design scientists".

Stage III: Feedback to Behavioral Scientists

It may well be that some of our early program problems stemmed from a lack of appreciation of the design profession on the part of their intended "clients", especially the social scientists. However, further examination seemed to indicate that the potential contributions of the social scientists to the environmental designers were possibly much more limited than many of us initially perceived. This may be particularly true of the behavioral aspects -- which, of course, are root elements of most of the social sciences.

We were impressed, for example, by a fairly recent statement made by the President's Chief Scientific Advisor, Dr. Donald Hornig:

> It seems to me that one of the biggest problems is to get a clearcut view of what can be expected from the behavioral sciences, now and in the future, and what the most promising directions for advance are. At present, the subject is diffuse -- for example, the 24,000 members of the APA (American Psychological Association) are divided among 26 divisions and the APA publishes 13 specialized journals, which is somewhat bewildering to the outsider. This diffuseness, together with the apparent lack of a substantial body of generally accepted theoretical foundations, makes it difficult for me to perceive clearly how best to go forward. But the need is great and go forward we must.[8]

At this stage of our thinking then, we do see a potentially profitable linkage of "designers" and plural clients" in a fashion which suggests that both may advance, together, as respective specialists in environmental design. As we have suggested before, a third group, "decoders" or "design scientist", if you please, seem functionally imperative to the continuing growth of useful effort in this field. This scheme now becomes a continuous flow system.

In this never ending process the academic, plural "clients" are continuously investigating the impact of specific environments on design related facets of human behavior. They are concerned, of course, with the processes by which human value systems are created or inherent, with respect to human environments. The design scientists, potentially, may also perform certain monitoring functions -- conceptually, to the extent required to perform their functions of linkage and transformation. You will also note that we have conceptually enlarged the role of the "design scientist" to that of sharing a responsibility for making some of the criteria value judgments with the social scientists. As all of you well know, this is probably a good subject area for several other papers, but I believe the existence of this function within such a scheme as described here cannot be overlooked, though some of you may choose to question the set of relationships which the various groups depicted have to this function.

The design scientists are seen as formulating an ever growing body of findings, interpretations, and even hypotheses into considerations which designers will find to be of interest, and hopefully of use. The relationships depicted also suggest a continuing process of evolutionary, experimental designs in a somewhat more rigorously scientific sense of the term, "experiment". This also suggests that the designers will always find in this relationship ample room for the synthesizing, imaginative and esthetic elements of their functions, including the design of experimental environments. We would certainly not be the first nor the last to recognize that there will always remain an imperative "art" component to each of the design professions. Hopefully, the latest three dimensional solutions of academic designer groups, especially those which are experimental, will be a part of the cyclical scheme depicted to contribute perceptions of scientific value to each of the groups involved.

This stage of conceptualization was suggested, in part, by some of the other statements contained in papers related to our Urban Affairs Conference. Again, the group of Minnesota social scientists working on the Experimental City Project:

> The overall proposal ought, it seems to us, to postulate a developmental model -- not just a dynamic one. That is, we see a society as creating its own environment and values as it develops. We do not see the city as self-sufficient or in equilibrium in some 'optimal' or 'given' sense. The urban system of which the experimental city will be a part is 'open' and changing. New conditions constantly emerge. The values and goals of the society are not set.
>
> The major problem of model design is to facilitate and insure this mechanism of change. Attention must be focused on the nature of the present value system of our society and the way in which value judgments and operational decisions are made. We cannot establish goals other than those which provide for an environment of change.
>
> . . . .
>
> Means and Ends -- The problem of ends is basically a problem of how decisions are made, given options and alternatives. The Experimental City proposal gives the impression that ends are somehow given: that the behavioral process in arriving at social, political and economic decisions is not part of the experimental design. The tone of the proposal leads one to assume that sociologists, political scientists and economists will set the optima (ends) and that technology will provide the means.

> If the experimental City is a means to attain goals, certainly the question of how goals are set -- more appropriately, how they evolve -- should be part of the experimental design. Technology does not follow after but proceeds along with value decisions and the setting of goals. How political decisions are made, how social attitudes and goals are formulated, how economic benefits are judged must be part of the design of the Experimental City. Goals are not set by either technologists or social scientists, they are postulated by the community and are attained, if at all, over time.
>
> . . .We are both interested and intrigued as to how decisions are made. Not the least of our interests being the decisions of planners and engineers and social scientists as to how they make design decisions. We have a magnificent chance here to observe ourselves -- and to be observed by our colleagues and the community. We should, we feel, make capital out of that opportunity.[9]

This same theme is reinforced in Professor William Garrison's paper, "Science, Engineering, and the City".[10] In essence he proposes a strategy of actually designing, building, and monitoring a series of experimental environments. This attacks the question of how we might go about achieving the conceptual promise afforded by a technology of radical innovations, which among other benefits, might help us to alleviate undesirable levels of certain social tensions. He suggests that we suffer from a kind of intellectual circularity in trying to determine how radically different concepts of urban (or human) environment will actually perform in satisfying human requirements -- and which human requirements are best satisfied in a given environment. At the same time, we lack the usage of enough scientific knowledge as to what sets of human requirements the designers should use as major considerations if they were actually free of the constraints of present design practices and growth patterns. Professor Garrison suggests that unless such an experimental "break-out" is actually programmed, "we are likely to drift through the remainder of this century without having alternatives for urban growth and development beyond those which are simply extensions of existing urban centers".[11]

Action Implications

It should be emphasized that the methods of experiment and analysis postulated in Stage III are aimed at all design activities that create or alter our environment. Experimental cities are one useful aspect of this subject, but you will note that our outline suggests the great urgency, as well as the scientific value, of the "here and the now". Given the very practical and useful intentions of our mission, "grand designs" and new basic perceptions about environmental design must inevitably find their applications to the renovation or additions to our existing cities. I might suggest that such work may have its greatest immediate impact, in fact, on the worst of our man-made environments, the urban ghettos. As some of you may know, one output of our Urban Affairs Conference was to generate a specialized group to take a new kind of look at the urban ghetto. We have some hope, therefore, that the CIC program in the design science area may find important and useful relationships with the urban program. Such a statment as this does not, of course, preclude evolution of all of our habitats to radically new environmental concepts, including transformations of all sorts in land use itself. The history of human progress, the functional spatial relationships of our present environmental systems, and the processes of changing or altering our environment -- whatever these may be -- are most likely to be combinations of both the evolutionary and the revolutionary.

The preceding analysis and discussion brings us to two action questions. What suggestions could we make that might aid in the design or assessment of curricula in which many of you are now engaged? Second, what sort of program might academic consortia sponsor that takes advantage of their unique potentials? In the first instance, the ideas we offer may be "old wine", or even sound slightly presumptuous. To this I can only claim the privileges of an outsider who now finds himself involved -- which, of course, speaks to the imperatives of the second question.

1. "Design Science" Degrees

If our analysis is at all accurate, it seems a likely conclusion that more and more of you will take the initiative (as many of you already have) in offering new kinds of advanced, professional degrees. Your chairman alluded to this in memoranda relative to this meeting. As our second stage, we talked about a newly trained kind of professional, a "decoder". As our third stage, we generalized and expanded a bit on this notion and called him a "design scientist", and schematized his research and information-handling functions.

At some of your universities, this may mean a research degree in architecture or urban planning at the doctoral level. At others, it will be a more generalized degree, perhaps not in the School of Architecture or Design at all, and will, in fact, be termed a School or Department of "Design Science". There is one major CIC university in which the entire spectrum of the environmental design professions feeds graduate students into a separate "Department of Environmental Design", within the College of Letters and Science. They are planning to offer soon a Ph.D. Their stated area of concern is to provide advanced research and training to design professionals in "satisfying the human function needs of individuals simultaneously with the psychological and social requirements of purposeful activity".[12] This particular university is about to establish a school of architecture, and on a different campus than their Department of Environmental Design.

2. Organization Questions

It would appear to us that there are a limited number of universities that can initially undertake these new degree programs. A number of reasons such as support, graduate students, and faculty specilization have already been pointed out by Dean Kelly. As we see it, those who perceive their needs most concretely -- namely, yourselves -- are going to have to provide the initiative in activating such processes as are indicated in our Stage III outline. This means, according to our lights, some exceptional strength and depth in (1) the schools of professional design; (2) broadly trained social and life scientists able and willing to concern themselves with your needs; and (3) people who are leaders in the thought and philosophy of general systems theory and application, and who may have come from either of the first two groups or by some other route not presently related to either.

To some of you, this last statement may be somewhat controversial, but it is our present opinion, at least, that the goals and the growing body of work, as epitomized by the Society for General Systems Research, provide an appropriate focus of effort which is of great significance to the would-be "design scientist". The kinds of new perceptions, cross-disciplinary unities, and realistic assessments of our present scientific knowledge that may hasten the synthesizing role of the design scientist are probably to be found with the systems theoreticians. I find few intellectual currents which have so aroused my own hopes for new unities in scientific theory, and for more sophisticated ways to facilitate the team approaches to this work. May I quote Professor Kenneth Boulding in the first General Systems Yearbook:

> The great task of General Systems Theory is to develop inter-disciplinary structure ... we always pay for generality by sacrificing content ... But somewhere between the specific that has no meaning and the general that has no content there must be for each purpose and at each level of abstraction, an optimum degree of generality.[13]

Or, further down the line, after this group had changed its name to the Society for General Systems Research, a statement by Professor Russell Ackoff in the eighth General Systems Yearbook in 1963:

> My feeling is that the effort to find general principles that apply to both conceptual and

> concrete systems in one of the most promising aspects of system science ... it may close the gap between science and the arts and humanities.[14]

3. What Can A Consortium Do?

Dean Kelly has suggested in his pre-meeting notes that there may be advantages in consorted approaches to "design science" programs. I would agree with this. Accordingly, it may be of some value to both of us to describe what appear to be our own next steps.

As I previously pointed out, a CIC community of interest in this area was evidenced prior to the formation of our Council -- Professor Williams' CIC Committee on Urban and Regional Design. I would now suggest relating two new elements to Professor Williams' Committee, as suggested schematically in our Stage II outline. A group of "plural clients", the broadly trained life and social scientists, would be the first; the second group would be our "decoders", the "design scientists", who individually or as a team may be representative of leading thinkers in the general systems field. They should have gained a fairly deep understanding of the three dimensional design process. They should also understand, in some depth, the conditions and the limitations under which the behavioral and life scientists can make effective contributions to the perceptions of the designers. This group, in particular, will have to be willing and able to forge some of the value judgments about environmental performance standards which seem an important element of the experimental processes we have proposed. Our first step, then, would be to gather as a general committee -- as we have done in other program areas -- and proceed to define what we might better do together than separately. Judging from past experience, our first efforts are likely to be an inventory of where we may provide mutual assistance to each other, not only through information exchange, but by recognition of special strengths on particular campuses. The enlarged group would, hopefully, provide a new perception of how design science curricula may best be established within the CIC community. Further down the road, the "design science" steering committee would probably put together cooperative research programs, possibly a group of separate, but closely interrelated, series of experiments carried on as comparative projects by a number of different universities at several different locations. Perhaps, for example, the work at the University of Minnesota then becomes a pilot project for such a series of environmental studies as are suggested by Professor Garrison's paper.

There is another aspect to this inter-university steering group which may strengthen the quality of the efforts proposed. At this moment, we seem to be talking about the assembly of a very rare and exceptionally talented group of scientists. We might reasonably expect to have better success along this line by being able to draw from eleven great universities than from just one. To the extent that these individuals can be brought together as a working team, we may induce some of the "critical mass" effects which become so exciting in advancing upon our scientific frontiers. To some slight extent, we have already had such experience, and we are considering organization and communication mechanisms to further facilitate it.

It is important that our zest for all-star research teams not be allowed to interfere unduly with instructional responsibilities. We would expect and hope that such programs as our steering group might devise would also provide some of the advanced training and experience for graduate students, the faculty and highest level practitioners of the next decades. At this point, we would also expect to see activation of the CIC Traveling Scholar Program in this field.

One interesting possibility suggested by one of your colleagues is that the individual schools, perhaps by planning and agreement, may become specialists on certain types of functional usage: schools, hospitals, housing, etc.; or on certain scales of design: some at the scale of interior furnishing and industrial product design, others at building design, others at urban and regional design. Within a consortium such as ours, we might eventually hope to provide research and training of the highest quality across the full spectra of both scale and function.

Footnotes to Chapter Five:

[1] Burnham Kelly, *The Prefabrication of Houses* (New York, 1951), p. 137.

[2] Testimony before the Committee on Government Operations, U.S. House of Representatives, 90th Congress, 1st Session; published in "The Adequacy and Usefulness of Federally Financed Research on Major National Social Problems", *The Use of Social Research in Federal Domestic Programs*, Part II (Washington, 1967), p. 507.

[3] See unpubl. art. (March 1, 1966) by Daniel Alpert, et al., "A Proposal for the Establishment of the Council on Economic Growth, Technology, and Public Policy of the Committee on Institutional Cooperation".

[4] Policy Paper of the CIC Council on Economic Growth, Technology, and Public Policy (Jan. 1967), p. 1.

[5] See unbubl. conference report (Madison, 1968), "Inter-university Programs in Urban Affairs", pp. 12-13.

[6] *Ibid.*, p. XXXIX.

[7] See unbubl. art. (Minnesota, 1968), "Supplement Seminar I and II Papers of the EXPERIMENTAL CITY PROJECT", p. 5.

[8] In an address before the American Psychological Association, October, 1965.

[9] *Op. cit.* (note 7, above), pp. 3-4.

[10] In National Academy of Sciences Publication No. 1498, (Washington, 1967).

[11] *Ibid.*

[12] Brochure of the Environmental Design Center, University of Wisconsin, (Madison, 1968).

[13] "General Systems Theory -- The Skeleton Science", (New York, 1956.

[14] "General Systems Theory and Systems Research: Contrasting Conceptions of Systems Science", (New York, 1963).

Chapter Six

GRADUATE EDUCATION PROGRAMS OF THE NATIONAL SCIENCE FOUNDATION

by Alice P. Withrow

It has been difficult in the past for architecture to obtain research support from the major foundations. This situation is beginning to change, as a result of the critical importance of making improvements in our urban environment. The development of graduate programs of scholarship and research may be expected to produce further change. Dr. Withrow was asked to comment on this possibility at the Chicago Conference.

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I would like first to review some of the requirements for graduate-degree program support and secondly to offer information on Foundation activities related to graduate education. Although I have relatively little expertise in the field of architecture, I have worked for several years at the Foundation with proposals and programs dealing with graduate-level education in science. There may be possibilities in some of these programs for interdisciplinary projects involving architecture and a science appropriate for Foundation consideration.

I. The specific and detailed requirements for a graduate-degree program may vary widely with the specific objectives to be achieved, but a good bachelors' program this year will not result in an excellent Ph.D. program next year; there is no formula for an instant, successful Ph.D. program. If no graduate degree is currently offered, it is advisable to initiate a graduate program with a Masters' degree before going on to a Ph.D.; the first step is to accumulate a good graduate staff. It may be a long process involving several years or more before a successful staff for a Ph.D. program can be established, even when it is built on a Masters' program. Surprisingly graduate students are not necessarily by-passing the Masters', despite the opinions of some educators. Many obtain a Masters' on the way to a Ph.D., and the proportion of Masters' in relation to the total Ph.D.'s awarded has not decreased in recent years, although the annual number of Ph.D.'s awarded has increased markedly. There are 212 universities in the country which grant the Ph.D. research doctorate in areas the Foundation supports; this has increased in number by a few each year. Individuals receiving the Ph.D. degree in June, 1967 from these 212 universities totaled approximately 17,865. Four universities granted more than 500 Ph.D.'s each. I might also note that there were more than twice as many Ph.D.'s granted as in 1961.

But let's return to the discussion of graduate staff qualifications. The staff must be research oriented if a research doctorate is to be given, since research supervision is required. Consequently, there must be an ongoing research program and a certain proportion of the staff will hold the doctorate, perhaps not always in the field of architecture, but in allied fields. Dean Kelly and Mr. McCue spoke to the fact that in some of the doctorate programs concerned with architecture, the individual staff members may have degrees in other fields. In this connection, I might mention that NSF has supported some training programs in architecture where the allied field was engineering or a behavioral science since architecture itself is not one of the fields considered as qualifying for NSF support. There is a limited number of senior and distinguished individuals in any field, and this is certainly true in science. In many areas of science there has been great expansion and a number of developing departments have had difficulty in appointing well-known individuals. Fortunately, however, in most areas of science, there are many upcoming younger Ph.D.'s who, if they have the proper training and background, will provide a longer period of good and useful professional service than can the older and better-established individuals.

I would like to stress the research component of graduate education. As a scientist, I have a prejudice in favor of research as that part of one's profession which determines the degree and direction of the progress that the profession makes. Today, with our vast and developing technology, our population increase, and the immediate translation of our scientific findings into actual use, it is difficult for a field to become competitive and to find its role in modern-day society without a research program. In addition, having research underway in a department more easily permits non-research personnel to keep abreast of progress in a field. For the individual who is interested in practicing a profession and who does not have a research-oriented attitude, this kind of contact adds much to his background since it takes a special effort to go to the university library for a lot of reading "just to keep up".

In addition to faculty, relevant factors include the proposed graduate courses, the critical number of courses, the area or areas of special competence to be stressed, and whether these areas parallel the research programs. Library facilities and the number of journals received which report research results are important. The kind and amount of space allotted by the universities must be considered, as well as the cost and time required for rehabilitation to bring the facilities up to the requirements specified.

The other side of the coin is the graduate student. The number and type of applicants, their undergraduate training, and the kind of support to be offered are all important. Securing good staff and good graduate students and securing support for both has become one of the major administrative problems of present day graduate education; certainly energy and time are required for writing proposals, making applications, and waiting for decisions.

II. The second part of this discussion deals with Foundation programs; to do that I will outline the organizational structure of the Foundation. The overall direction of the Foundation is by the National Science Board which determines Foundation policy, and this policy is administered by a Director and an Executive Associate Director. In the next echelon are three Associate Directors, respectively in charge of research, of education, and of institutional relations; the last is concerned with support for the overall development of universities and university departments. The Associate Directors supervise Divisions and certain Offices.

The research divisions encompass all of the sciences supported by the Foundation and include the Divisions of Environmental Sciences, Mathematical and Physical Sciences, Biological and Medical Sciences, Engineering, and Social Sciences, and the Office of Sea Grant

Programs. There are three education divisions, namely pre-college education, undergraduate education, and graduate education. The assignments to these divisions are not necessarily on the basis of the level of work supported, but on the basis of the professional level of the individual being trained. Thus, the mission of the Division of Pre-College Education in Science is to improve science education at the elementary and secondary school levels; this Division considers proposals for institutes for high school teachers who may be taking graduate courses, as well as training programs for very well-qualified high school students and institutes for elementary school teachers. The Division of Undergraduate Education in Science deals with programs for undergraduate students and programs for the development of undergraduate faculty or for curricula development. The third is the Division of Graduate Education in Science which will be discussed in greater detail later.

There are general rules governing the submission of proposals to the Foundation. Submissions may be made by universities, nonprofit research and educational organizations, professional societies and, on occasion, foreign institutions of these types. Applications are eligible from the following fields: mathematical, physical, medical (but not clinical), biological, engineering and social sciences and the history and philosophy of science, as well as interdisciplinary areas which involve two or more of these, or interdisciplinary areas which involve one of these and a non-science area. The proposals received are evaluated by panels and individuals selected from the scientific community; proposals are supported in the order of merit to the extent of funds available.

This covers in a general way the structure and organization of the Foundation. Since your interest is primarily at the graduate level, I would like to deal in more detail with the programs developed at the Foundation for support of graduate education in science; this may be helpful in developing graduate programs in architecture. Included in the Division of Graduate Education in Science are the Advanced Science Education Program and the Fellowships and Traineeship programs.

With continuing guidance from, and in cooperation with the scientific and academic communities, the Division of Graduate Education in Science of the Foundation, through these programs, is striving to accomplish the following objectives:

1) further the scientific training (including meaningful teaching experience) of high-ability graduate students and scientists to meet the Nation's ever-pressing need for trained scientific manpower;

2) develop the graduate science departments of academic institutions on a broader scale, thus contributing to the growth of new centers of excellence;

3) provide for a wider geographical distribution of support

for the improvement of graduate education in the science, thus helping all areas in the United States to become stronger in science;

4) improve course content and instructional materials in the sciences at the graduate level, and assist in the development of new curricula;

5) provide opportunities for training in specialized areas of science -- usually at the frontiers of science -- for graduate and post-doctoral students and graduate faculty; also, provide training opportunities in areas of science which are known to be, or expected to be in the foreseeable future, in short supply of well-trained manpower;

6) foster programs for international scientific activities that will assist in the strengthening of graduate training in the sciences and of scientific research potential in the United States;

7) improve the scientific literacy of the American public at large.

To carry out these objectives, the Foundation has established, within the Division for the fiscal year 1968:

1) 2500 graduate fellowships with stipends up to $2800 per year plus tuition and fees and dependency and travel allowances.

2) 5656 graduate traineeships, with similar stipends and fees.

3) 965 summer traineeships with stipends up to $85 per week plus tuition and fees.

4) 120 postdoctoral fellowships with stipends up to $7000 per year, plus cost-of-education allowance to the host institution and special dependency and travel allowances.

5) 55 senior postdoctoral fellowships on a salary matching basis with a maximum NSF contribution of $15,000 plus travel allowance.

6) 223 science faculty fellowships on a similar basis.

7) 65 senior foreign scientist fellowships on a similar basis.

8) 39 NATO postdoctoral fellowships in science with stipend up to $6500 for 12 months and special, dependency, and travel allowances.

9) 13 NATO Senior fellowships in science on short term basis, with subsistence and travel allowances.

The remaining program in the Division is termed Advanced Science Education, and is comprised of three sub-units: Special Projects in Graduate Education; Advanced Science Seminar Projects; and Public Understanding of Science Projects. The latter probably will not be of much help to architects in furthering graduate programs. The objective of the program is to increase the public's knowledge of scientific facts, to give it some insight into the processes used to arrive at scientific "truth", and to make it aware of the social and cultural consequences of scientific findings. Advanced Science Seminars provide opportunities for advanced and specialized education and research training, and supplement graduate school curricula, and enable participants to pursue science subject areas in greater depth than usually possible in regularly scheduled university activities. A Seminar may be in the form of (1) a special formal classroom or laboratory course, (2) research training, (3) field training, or (4) a conference or symposium. It may focus on a single subject or be interdisciplinary in nature; often the subject is in a highly specialized area. The guidelines are intentionally made flexible to enable the Foundation to support a wide variety of graduate training activities. The main requirements are that the activity be substantive, that it be presented at the graduate or a more advanced level, and that participants be selected on a regional or national level.

The general objective of Special Projects in Graduate Education is to offer support for innovative programs in science education at the graduate level. The scope of these projects includes: strengthening of a graduate-degree program by the development of new or special course offerings, including the design and preparation of films and other educational aids; revision of a graduate science curriculum; improvement of graduate-level training programs for pre-service junior college and college science teachers; extension of undergraduate programs to the graduate level; development of courses that may serve as models for incorporation into graduate programs in other institutions; initiation or strengthening of inter-institutional programs by which the faculty and graduate students of the cooperating schools may receive advanced educational training; support of special conferences or studies on national problems in graduate education; and support of other experimental programs designed to improve graduate education in the sciences.

Another program which may be of interest is the Departmental Science Development Program, a part of Institutional Relations, which is designed to improve the quality of educational and research activity in individual areas of science and engineering. The scope of this program normally coincides with a university department but may also include an interdisciplinary entity.

Chapter Seven

FORMAL ACTION BY THE ASSOCIATION OF COLLEGIATE SCHOOLS OF ARCHITECTURE

by Burnham Kelly

This chapter summarizes the background of the steps taken by the Committee on Graduate Study and Research, the presentations made by the Committee to the annual convention of the Association of Collegiate Schools of Architecture in Portland, Oregon, and the actions taken by the convention.

Burnham Kelly is Co-Chairman of the Committee on Graduate Study and Research and Dean of the College of Architecture, Art, and Planning at Cornell University.

The Association of Collegiate Schools of Architecture has from the start had as one of its major concerns the constant improvement of education in architecture. In recent years, as aims and methods of architectural education have come under general review and as the responsibilities and opportunities of the profession itself have been challenged, there has been a general feeling that strong measures are needed. The entire scope of education must be surveyed, from the primary grades where fundamentals of visual perception must be learned if our society is to know and demand good design, to the long-time practitioners who need an understanding of the potentials of new methods, materials, and systems. A relatively small part of the problem is the assignment of the Committee on Graduate Study and Research.

Within this seemingly narrow focus, however, much of current architectural education is included. The largest number of accredited school programs in architecture are five-year undergraduate professional programs, but a significant and growing minority have turned to six-year programs in which the last two years are considered to be graduate study, and a small but growing number are entirely graduate programs, requiring a bachelor's degree for admission. Clearly, the schools have been revising their curricula, and the Association of Collegiate Schools has encouraged these changes through a series of committee discussions, publications, special seminars, and general meetings.

The American Institute of Architects has also given continuing attention to the improvement of architectural education, concentrating in recent years on the need to expand the responsibility of the profession to include the full scope of the three-dimensional phhsical environment. Two years ago, the AIA asked Robert Geddes, Dean of the Princeton School to make a broad study of architectural education. This study led to the publication this year of the AIA-Princeton Report[1] and a great deal of subsequent discussion in the profession and the schools. The Architectural Forum[2] expressed encouragement at the great scope suggested in the report for the mission of environmental design and at the broad call for systematic, significant, and innovative curriculum developments. Although he acknowledged these virtues, Jonathan Barnett in the Architectural Record[3] raised serious question regarding the implications of so inclusive a definition and so general a prescription, not only for those who must develop educational programs, but also for the future make-up of the AIA itself and of the professional registration examinations.

At its annual meeting in June, 1968, the Association of Collegiate Schools discussed the AIA-Princeton Report at length, and raised a number of questions while recognizing the general contributions of the study.[4] At least in part, the representatives of the schools were looking for detailed recommendations dealing with specific aspects of the problem.

It should be noted that the present project of the ACSA Committee on Graduate Study and Research is intended to deal with one such specific aspect. Originally proposed before the AIA-Princeton study, it was planned and carried out in close cooperation with the AIA, as may be seen from the presence on the ACSA project committee of the AIA director of research programs and the co-director of the AIA-Princeton study.

This project has taken as its specific subject of concern the urgent need of architects, in school and in practice, for a broad base of knowledge regarding developments in all aspects of science and technology, and regarding the effective application in their field of new ideas and techniques. With this aim in view and with the support of the U.S. Office of Education and the Graham Foundation, the Committee held a Conference on this subject in Chicago in April, 1968, to which representatives of all the member schools of the Association of Collegiate Schools of Architecture were invited.

The earlier sections of this report are derived from presentations at the Conference. From the discussions that followed, a series of agreements were reached, on the basis of which resolutions were offered at the ACSA Annual Convention in Portland, Oregon, in June, 1968.

1) Agreed: the time has come for ACSA to state its views regarding the development of graduate programs of scholarship and research within the schools of architecture.

> RESOLVED: that the Association of Collegiate Schools of Architecture support the development within the schools of architecture of graduate programs of scholarship and research.

In the discussion, the members were reminded that the architecture schools can no longer count on having the needed research and development done in other departments and brought over to architecture, that the pressures and interests for research and scholarship are great but that actual programs in the schools are still few, and hence that the time is ripe for action. The members were also asked to distinguish the exposure to scholarship and research which should be part of the regular training for the design professional from the concentration on scholarship and research which is a basic ingredient of special graduate programs.

The resolution carried without dissent.

2) Agreed: general guidance and advice on degree structure will be useful to schools undertaking new graduate programs.

> RESOLVED: that the Association of Collegiate Schools

of Architecture support circulation of the booklets on Professional Doctorates and the PhD prepared by the Council of Graduate Schools,^{5} together with such added material on our field as may be appropriate, to assist schools in setting up professional doctorates or PhD programs.

The complexities in the emerging degree structure were summarized for the members, as were the expenses and difficulties involved in setting up a sound PhD program. It was noted that the distinction between the PhD and the Professional Doctorate, both of which are needed, is clarified in the separate booklets published by the Council of Graduate Schools, that scholars and researchers must no longer be treated as second class citizens, and that for them the appropriate degree is the PhD.

The phrasing of the resolution was questioned from the floor, because it is open to the interpretation that there might conceivably be set up certain approved standards through the application of which future graduate programs in all schools would be governed, by ACSA. The Committee disclaimed any such desire, stressing the choice of the word "assist." There is no intent to establish an approved standard to which all schools must adhere. Yet the Committee clearly is seeking to improve programs in an indirect way by calling attention to concrete examples and models as well as by offering assistance. We can assume that these illustrative standards will carry weight with the graduate schools and the key administrators in universities in which the architectural school wishes to offer the doctorate.

The Committee also recognizes that there are advantages in encouraging comparable standards among the schools so that the consortium device may be more easily developed as a means of making broad programs available without requiring the individual school to offer the full range of subjects.

The Committee was also asked about the implications of stimulating doctoral studies on the possibility that the doctorate might soon become the normal terminal degree for good students and required for all faculty members--as is the case in most other fields. The Committee made it clear that it had no intention of advancing the doctorate as the regular terminal degree in architecture. Rather, the purpose has been to encourage the schools to develop for themselves the supporting scholarship and research competence that will strengthen the initial and advance professional programs but should not be confused with them.

The resolution carried without dissent.

3) Agreed: there may be substantial benefits for individual schools derived from cooperative action by ACSA to obtain support for the development of graduate programs in scholarship and research.

> RESOLVED: That the Collegiate Schools of Architecture supports the objective of joint approaches to offices, agencies, foundations, and industry for funds to support programs of fellowships, publication, conferences, institutes, and collaborative programs, and authorizes the Committee on Graduate Study and Research to make such approaches or to add ACSA endorsement to proposals or requests submitted by ACSA schools in groups or individually in pursuit of the educational goals of ACSA, and to recommend procedures for the allocation of funds awarded to ACSA as a result of any such proposals or requests.

The Committee reviewed the many possible advantages of joint action, even for schools which would not at first get direct support but might benefit by getting such indirect benefits as part-time teaching, faculty scholarships, new teaching materials, and a scholarly journal, and illustrations were noted. It was stressed that the intent of the ACSA effort would be to supplement but not to supersede individual efforts on the part of the schools.

Again, the open-ended character of the resolution was questioned. The refusal or failure of ACSA to endorse a proposal might be considered a deficiency, and yet no standards are established for the implied value judgments. The Committee recognized that this is a delicate point that might one day become sensitive. Yet there is reason to try to move rapidly, and the Committee is an appropriate body for interim action. The Committee stated its intention at this early stage of using its support liberally, and of seeking in every case to modify rather than to refuse to approve a proposal. To the fear that government agencies might quickly make use of ACSA approval as a screening device, the Committee expressed doubt that this could happen soon, and added that the Committee could in any case be called to account or reduced in authority at the next annual convention or, if need be, at any time.

The resolution carried by a vote of approximately three to one.

4) Agreed: a continuing service is desirable, to advise the schools on sources of funds, on manpower, on program requirements, etc.

> RESOLVED: that a committee be established to consider the operational aims, structure, and means of support for a service agency to be established by the Association of Collegiate Schools of Architecture for the purpose of providing educational services to the schools, with specific attention to the provision of advisory service and guidance to member schools engaged in establishing graduate programs of scholarship and research.

The Committee stated its views that the time has come for ACSA to create a continuing, independent agency to provide a range of services for the schools, and that such an agency would have many operational and advisory functions that are far broader than the concerns of the Committee. If such a continuing agency existed, for example, it could have directed the present project.

The resolution carried without dissent.

Footnotes to Chapter Seven:

1) "A Study of Education for Environmental Design," a Report by Princeton University for The American Institute of Architects, Princeton University, December 1967.

2) "Education and the AIA: A Process for Change," Vol 128, no 4, May 1968, pp 86-7.

3) "Educating 'Environmental Designers'," Architectural Record, Vol 144, no 4, Oct. 1968, pp 163-166.

4) The discussion is summarized in an article by Philip Dole, "ACSA and the Princeton Report," AIA Journal, Vol XLX, no 3, September, 1968, pp 74-77.

5) The Doctor of Philosophy Degree, a statement by the Association of Graduate Schools in the Association of American Universities and The Council of Graduate Schools in the United States, Fifth Printing, February 1968; The Doctor's Degree in Professional Fields, a statement by The Association of Graduate Schools in the Association of American Universities and The Council of Graduate Schools in the United States, Second Printing, February 1967; and New Doctor of Philosophy Degree Programs, a statement by The Council of Graduate Schools in the United States, Fifth Printing, February 1969.

Conclusion and Evaluation

The Committee on Graduate Study and Research has stimulated broad consideration among the schools on a particular issue of prime importance in architectural education, and agreement has been reached by the Association of Collegiate Schools of Architecture to support the development within schools of architecture of graduate programs of scholarship and research, to assist the schools in attaining suitable standards for such programs, and to stimulate joint approaches by the schools for the necessary support of all sorts. A procedure for adding ACSA endorsement to individual or joint proposals has been established, together with a procedure for allocating to the schools any funds awarded to ACSA as a result of any such proposals or requests. The stage has been set for informed and effective action to provide a vitally important aspect of architectural education and service to the profession.

The Committee has also secured agreement by the ACSA that the activities contemplated by these resolutions, together with those required for many other educational purposes, require the establishment of an independent, continuing service agency. Progress on this front is the essential next step.

Appendix A

A.C.S.A. Committee on Graduate Study and Research
Conference on Graduate Study in Architecture
Jointly sponsered by the U.S. Office of Education
and the Graham Foundation for Advanced
Study in the Fine Arts

AGENDA

Thursday, April 25, 1968 — The Graham Foundation
4 West Burton Place

1:00 p.m. Registration and Information

2:00 p.m. Opening session
    Welcome - John Entenza
    Problems and Potentials - Burnham Kelly
    Insights from the Princeton Study - Robert L. Geddes
    The Experience of Berkeley - Gerald M. McCue

5:30 p.m. Cocktails

8:30 p.m. Informal group meetings:
Degree Structure, Institute of Advanced Study
Collaborative and Multidisciplinary Programs, Research in Progress, etc.

Friday, April 26, 1968 — University of Illinois
Chicago Circle Campus
Chicago Circle Center Building

9:00 a.m. Second Session - Illinois Room 324
    Welcome - Leonard J. Currie
    Insights from Science - Dr. Benjamin Nichols
    Insights from Medicine - Dr. John Z. Bowers
    Discussion

12 noon Served Luncheon - Illinois Room 323

2:00 p.m. Closing Session - Illinois Room 324
    Role of the National Science Foundation - Dr. Alice P. Withrow
    The Design Scientist - Carlisle P. Runge
    Discussion

Appendix B.

The following is a list of the Accredited Schools of Architecture. Those which were represented at the Conference in Chicago in April, 1968, are marked by an asterisk.

University of Arizona*
Arizona State University
University of Arkansas
Auburn University*
University of California*
California State Polytechnic College
Carnegie-Mellon University*
Case Western Reserve University
Catholic University*
University of Cincinnati*
The City College of the City University
  of N. Y.
Clemson University
University of Colorado*
Columbia University
Cooper Union*
Cornell University*
University of Detroit
University of Florida*
Georgia Institute of Technology
Harvard University*
University of Houston
Howard University
Illinois Institute of Technology*
University of Illinois*
Iowa State University
Kansas State University
University of Kansas*
Kent State University*
University of Kentucky*
Louisiana State University
Massachusetts Institute of Technology*
Miami University
University of Michigan*
University of Minnesota*
Montana State University
University of Nebraska*
University of New Mexico
North Carolina State University
University of Notre Dame
Ohio University*
Ohio State University*
Oklahoma State University*
University of Oklahoma*

University of Oregon*
University of Pennsylvania*
Pennsylvania State University
Pratt Institute
Princeton University*
Rensselaer Polytechnic Institute*
Rhode Island School of Design
Rice University*
University of Southern California*
Syracuse University*
Texas A. & M. University
Texas Technological College*
University of Texas*
Tulane University*
University of Utah*
Virginia Polytechnic Institute
University of Virginia*
Washington University
University of Washington
Yale University*

Associate member schools and other schools represented at the Conference:

Ball State University
University of British Columbia
University of Manitoba
University of Maryland
University of Southwestern Louisiana
University of Toronto
University of Wisconsin
University of Illinois, Chicago Circle Campus, host

Guests at the Conference included:

Dr. John Z. Bowers, Josiah Macy Foundation
Robert M. Dillon, Building Research Advisory Board
James Ellison, American Institute of Architects
 and Association of Collegiate Schools of Architecture
John D. Entenza, Graham Foundation
Harold Horowitz, National Science Foundation
Coryl LaRue Jones, Department of Health, Education, and Welfare
Benjamin Nichols, Cornell University
Carlisle P. Runge, University of Wisconsin
Alice P. Withrow, National Science Foundation